VOLUME 14 NUMBER 6 / MARCH 23, 1976

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N76-15014*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
AN ASSESSMENT OF LIGHTER THAN AIR TECHNOLOGY Final Report
Joseph F. Vittek, Jr., ed. Jun. 1975 84 p Final Report of Interagency Workshop on Lighter than Air Vehicles, Monterey, Calif., Sep. 1974 Sponsored in part by Navy, DOT, and FAA (Grant NsG-2024)
(NASA-CR-137799; FTL-R75-1) Avail: NTIS HC $5.00 CSCL 01B

The workshop on LTA is summarized. The history and background are reviewed. The workshop reports for the following working groups are presented: policy, market analysis, economics, operations, and technology. F.O.S.

N76-15015*# Massachusetts Inst. of Tech., Cambridge.
PROCEEDINGS OF THE INTERAGENCY WORKSHOP ON LIGHTER THAN AIR VEHICLES
Joseph F. Vittek, Jr., ed. Jan. 1975 692 p refs Proc. held at Monterey, Calif., Sep. 1974 Sponsored in part by Navy, DOT, and FAA
(Grant NsG-2024)
(NASA-CR-137800; FTL-R75-2) Avail: NTIS HC $16.25 CSCL 01B

Papers presented at the workshop are reported. Topics discussed include: economic and market analysis, technical and design considerations, manufacturing and operations, design concepts, airship applications, and unmanned and tethered systems. For individual titles, see N76-15016 through N76-15073.

N76-15016* Massachusetts Inst. of Tech., Cambridge.
BASIC RELATIONSHIPS FOR LTA ECONOMIC ANALYSIS **c83**
Raymond A. Ausrotas *In its* Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 1-6 refs (For availability see N76-15015 06-01)
CSCL 05C

Operating costs based on data of actual and proposed airships for conventional lighter than air craft (LTA) are presented. An economic comparison of LTA with the B-47F is included, and possible LTA economic trends are discussed. Author

N76-15017* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY ESTIMATES OF OPERATING COSTS FOR LIGHTER THAN AIR TRANSPORTS **c83**
C. L. Smith and M. D. Ardema *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 7-19 refs (For availability see N76-15015 06-01)
CSCL 05C

A preliminary set of operating cost relationships are presented for airship transports. The starting point for the development of the relationships is the direct operating cost formulae and the indirect operating cost categories commonly used for estimating costs of heavier than air commercial transports. Modifications are made to the relationships to account for the unique features of airships. To illustrate the cost estimating method, the operating costs of selected airship cargo transports are computed. Conventional fully buoyant and hybrid semi-buoyant systems are investigated for a variety of speeds, payloads, ranges, and altitudes. Comparisons are made with aircraft transports for a range of cargo densities. Author

N76-15018* Holland America Line, Rotterdam (Netherlands).
COMPARATIVE AIRSHIP ECONOMICS **c83**
Robert Harthoorn *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 21-30 refs (For availability see N76-15015 06-01)
CSCL 05C

As future LTA vehicles will be doomed right from the start if they do not fill a real need, some differences in transport philosophy between design engineers on the one hand and freight forwarders on the other are discussed. Watching rising costs of energy necessary to transport our cargo from A to B, and realizing that this price of energy is always included in the product's selling price at B, the apparent correlation between installed specific tractive force per unit of cargo weight and pure freighting cost are contemplated. Very speedy and progressive Airship designs are mistrusted, because the key to any low cost transport tool is to design it for its given task only, without any unnecessary sophistication. Author

N76-15019* Goodyear Aerospace Corp., Akron, Ohio.
EFFECT OF PRESENT TECHNOLOGY ON AIRSHIP CAPABILITIES **c05**
Robert T. Madden *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 31-40 (For availability see N76-15015 06-01)
CSCL 01B

The effect is presented of updating past airship designs using current materials and propulsion systems to determine new airship performance and productivity capabilities. New materials and power plants permit reductions in the empty weights and increases in the useful load capabilities of past airship designs. The increased useful load capability results in increased productivity for a given range, i.e., either increased payload at the same operating speed or increased operating speed for the same payload weight or combinations of both. Estimated investment costs and operating costs are presented to indicate the significant cost parameters in estimating transportation costs of payloads in cents per ton mile. Investment costs are presented considering production lots of 1, 10 and 100 units. Operating costs are presented considering flight speeds and ranges. Author

N76-15020* Southern California Aviation Council, Inc., Pasadena.
AIRSHIP ECONOMICS **c83**
Richard D. Neumann and L. R. Mike Hackney *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 41-52 refs (For availability see N76-15015 06-01)
CSCL 05C

Projected operating and manufacturing costs of a large airship design which are considered practical with today's technology and environment are discussed. Data and information developed during an 18-month study on the question of feasibility, engineering, economics and production problems related to a large metalclad type airship are considered. An overview of other classic airship designs are provided, and why metalclad was selected as the most prudent and most economic design to be considered in the 1970-80 era is explained. Crew operation, ATC and enroute requirements are covered along with the question of handling, maintenance and application of systems to the large airship. Author

N76-15021* Southern California Aviation Council, Inc., Pasadena.
SOME ECONOMIC TABLES FOR AIRSHIPS c83
Richard D. Neumann *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 53-61 (For availability see N76-15015 06-01)
CSCL 05C

During the course of the Southern California Aviation Council study on lighter than air it was determined that some form of economic base must be developed for estimation of costs of the airship. The tables are presented. Author

N76-15022* Cranfield Inst. of Technology (England).
A STUDY OF DESIGN TRADE (OFFS) USING A COMPUTER MODEL c05
Stephen Coughlin *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 63-73 ref (For availability see N76-15015 06-01)
CSCL 01B

The interaction between the efficiency of the structural design and the cost of the structure used was studied. It is shown that future effort is best directed at producing a low cost structure of medium efficiency, but with the ability to withstand normal service wear. The trade-off between aerodynamic drag and structure weight in selecting a length to diameter ratio for the hull is evaluated along with the implications of power plan type and fuel cost on the economics of the airship. The choice of lifting gas is considered. Author

N76-15023* Naval Academy, Annapolis, Md.
AN ECONOMIC COMPARISON OF THREE HEAVY LIFT AIRBORNE SYSTEMS c83
Bernard H. Carson *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 75-85 refs (For availability see N76-15015 06-01)
CSCL 05C

Current state of art trends indicate that a 50-ton payload helicopter could be built by the end of the decade. However, alternative aircraft that employ LTA principles are shown to be more economically attractive, both in terms of investment and operating costs for the ultra-heavy lift role. Costing methodology follows rationale developed by airframe manufacturers, and includes learning curve factors. Author

N76-15024* Massachusetts Inst. of Tech., Cambridge.
AN APPROACH TO MARKET ANALYSIS FOR LIGHTER THAN AIR TRANSPORTATION OF FREIGHT c83
Paul O. Roberts, Henry S. Marcus, and Jean H. Pollock (Babson Coll., Babson Park, Mass.) *In its* Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 87-110 refs (For availability see N76-15015 06-01)
CSCL 05C

An approach is presented to marketing analysis for lighter than air vehicles in a commercial freight market. After a discussion of key characteristics of supply and demand factors, a three-phase approach to marketing analysis is described. The existing transportation systems are quantitatively defined and possible roles for lighter than air vehicles within this framework are postulated. The marketing analysis views the situation from the perspective of both the shipper and the carrier. A demand for freight service is assumed and the resulting supply characteristics are determined. Then, these supply characteristics are used to establish the demand for competing modes. The process is then iterated to arrive at the market solution. Author

N76-15025* Aerospace Developments, London (England).
MARKET ASSESSMENT IN CONNECTION WITH LIGHTER THAN AIR c83
John E. R. Wood *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 111-121 (For availability see N76-15015 06-01)
CSCL 05C

A review of the marketability of the airship is given, and the relative energy consumption and speed potential of the airship is compared to other modes and guidelines to areas of initial development are also provided, together with a brief historical review. Author

N76-15026* Massachusetts Inst. of Tech., Cambridge.
BASIC RELATIONSHIPS FOR LTA TECHNICAL ANALYSIS c05
Raymond A. Ausrotas *In its* Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 123-131 refs (For availability see N76-15015 06-01)
CSCL 01B

An introduction to airship performance is presented. Static lift equations are shown which, when combined with power requirements for conventional airships, allow parametric studies of range, payload, speed and airship size. It is shown that very large airships are required to attain reasonable speeds at transoceanic ranges. Author

N76-15027* Naval Air Development Center, Warminster, Pa.
THE EFFECTS OF SELECTED MODERN TECHNOLOGICAL CONCEPTS ON THE PERFORMANCE AND HANDLING CHARACTERISTICS OF LTA VEHICLES c05
Carmen J. Mazza *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 133-146 refs (For availability see N76-15015 06-01)
CSCL 01B

The results of an airship design sensitivity study are presented. A wide variety of airship design concepts, including the classical and high aero-lift augmented-hybrids are examined with regard to specific technological improvements, and consequent gains in performance, stability and control and flying qualities. Variations in size, payload, power required and airspeed are quantitatively analyzed for airships representing aero-to-buoyant lift ratios of zero to 3.0 over a range of technology improvements implying reduced drag, reduced structural weight fractions and lighter, more efficient propulsion systems. Qualitatively, future airships are discussed in terms of stability, control and flying qualities requirements dictated by projected demands for vastly improved operational effectiveness and ease of handling. Such topics include stability augmentation systems, load-alleviation systems and total computer state-sensing and controls management systems. It was shown that, for the most part, highly refined conventional designs offer attractive gains in both performance and ease of handling. Hybrid airships represent a good potential for missions requiring the transport of heavy payloads at higher airspeeds over shorter ranges without the capability for sustained hover and vertical flight. Author

N76-15028* Goodyear Aerospace Corp., Akron, Ohio.
BOUNDARY LAYER CONTROL FOR AIRSHIPS c05
F. A. Pake and S. J. Pipitone *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 147-155 refs (For availability see N76-15015 06-01)
CSCL 01A

An investigation is summarized of the aerodynamic principle of boundary layer control for nonrigid LTA craft. The project included a wind tunnel test on a BLC body of revolution at zero angle of attack. Theoretical analysis is shown to be in excellent agreement with the test data. Methods are evolved for predicting the boundary layer development on a body of revolution and the suction pumping and propulsive power requirements. These methods are used to predict the performance characteristics of a full-scale airship. The analysis indicates that propulsive power reductions of 15 to 25 percent and endurance improvements of 20 to 40 percent may be realized in employing boundary-layer control to nonrigid airships. Author

N76-15029* Transportation Technology, Inc., Marblehead, Mass.
AIRSHIP STRESSES DUE TO VERTICAL VELOCITY

GRADIENTS AND ATMOSPHERIC TURBULENCE c05
Duncan Sheldon *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 157-168 refs (For availability see N76-15015 06-01)
CSCL 01A

Munk's potential flow method is used to calculate the resultant moment experienced by an ellipsoidal airship. This method is first used to calculate the moment arising from basic maneuvers considered by early designers, and then expended to calculate the moment arising from vertical velocity gradients and atmospheric turbulence. This resultant moment must be neutralized by the transverse force of the fins. The results show that vertical velocity gradients at a height of 6000 feet in thunderstorms produce a resultant moment approximately three to four times greater than the moment produced in still air by realistic values of pitch angle or steady turning. Realistic values of atmospheric turbulence produce a moment which is significantly less than the moment produced by maneuvers in still air. Author

N76-15030* Woodward (Donald E.), Alexandria, Va.
AN AERODYNAMIC LOAD CRITERION FOR AIRSHIPS c02
Donald E. Woodward *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 169-176 refs (For availability see N76-15015 06-01)
CSCL 01A

A simple aerodynamic bending moment envelope is derived for conventionally shaped airships. This criterion is intended to be used, much like the Naval Architect's standard wave, for preliminary estimates of longitudinal strength requirements. It should be useful in tradeoff studies between speed, fineness ratio, block coefficient, structure weight, and other such general parameters of airship design. Author

N76-15031* Naval Ordnance Lab., White Oak, Md.
THE PLANAR DYNAMICS OF AIRSHIPS c02
Frank J. Regan *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 177-186 refs (For availability see N76-15015 06-01)
CSCL 01A

The forces and moments acting upon a LTA vehicle are considered in order to develop parameters describing planar motion. Similar expressions for HTA vehicles will be given to emphasize the greater complexity of aerodynamic effects when buoyancy effects cannot be neglected. A brief summary is also given of the use of virtual mass coefficients to calculate loads on airships. Author

N76-15032* Ketron, Inc., Arlington, Va.
FLOATING VS FLYING: A PROPULSION ENERGY COMPARISON c05
Fendall Marbury *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 187-197 refs (For availability see N76-15015 06-01)
CSCL 01B

Floating craft are compared to those that fly. Drag/weight for floaters is shown to be proportional to v squared/L, while for flyers it is independent of size and speed. The transportation market will therefore assign airships to lower speeds than airplanes, and will favor large airship sizes. Drag of an airship is shown to be only 11 percent of submarine drag at equal displacement and speed, raising the possibility that airships can compete with some types of ships. Author

N76-15033* McMaster Univ., Hamilton (Ontario).
LONG FLUID FILLED BAGS SUSPENDED BY LINE FORCES c02
M. L. Mullins and J. L. Duncan *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 199-208 refs Sponsored in part by Natl. Res. Council of Canada (For availability see N76-15015 06-01)
CSCL 01A

A previous analysis of fluid filled storage bags is extended to the case of a long fluid filled cylindrical membrane supported by uniform line loads. Cross-sectional shape, stiffness of the support system and stress resultants in the membrane are determined. The application of the numerical results to problems arising in the design of nonrigid airships is discussed. Author

N76-15034* Utah Univ., Salt Lake City.
COMPUTER AIDED FLEXIBLE ENVELOPE DESIGNS c05
Ronald D. Resch *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 209-215 (For availability see N76-15015 06-01)
CSCL 01A

Computer aided design methods are presented for the design and construction of strong, lightweight structures which require complex and precise geometric definition. The first, flexible structures, is a unique system of modeling folded plate structures and space frames. It is possible to continuously vary the geometry of a space frame to produce large, clear spans with curvature. The second method deals with developable surfaces, where both folding and bending are explored with the observed constraint of available building materials, and what minimal distortion result in maximum design capability. Alternative inexpensive fabrication techniques are being developed to achieve computer defined enclosures which are extremely lightweight and mathematically highly precise. Author

N76-15035* Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
LTA APPLICATION OF A LONG TRAILING WIRE HIGH SPEED/LOW WEIGHT REELING SYSTEM c05
D. F. Werb *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 217-222 (For availability see N76-15015 06-01)
CSCL 01A

The successful development of a unique yet simple reeling system for handling long trailing tensile members at high speeds is described. This high speed when combined with the system simplicity, low weight and effective motive power consumption make this reeling system particularly attractive to LTA planners and designers for numerous LTA missions. Author

N76-15036* National Aeronautics and Space Administration, Washington, D.C.
LTA STRUCTURES AND MATERIALS TECHNOLOGY c05
Norman J. Mayer *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 223-241 refs (For availability see N76-15015 06-01)
CSCL 01C

The state-of-the-art concerning structures and materials technology is reviewed. It is shown that many present materials developments resulting from balloon and aircraft research programs can be applied to new concepts in LTA vehicles. Both buoyant and semi-buoyant vehicles utilize similar approaches to solving structural problems and could involve pressurized non-rigid and unpressurized rigid structures. System designs common to both and vital to structural integrity include much of the past technology as well. Further research is needed in determination of structural loads, especially in future design concepts. Author

N76-15037* Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
POTENTIAL CONTRIBUTION OF HIGH STRENGTH, HIGH MODULUS ARAMID FIBERS TO THE COMMERCIAL FEASIBILITY OF LIGHTER THAN AIR CRAFT c24
D. L. G. Sturgeon and T. K. Venkatachalam *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 243-255 refs (For availability see N76-15015 06-01)
CSCL 11D

Kevlar aramid fiber, fabric, rope and cable performance are reviewed along with the economics relevant to the material, structural, and reliability aspects of lighter than air craft. Author

N76-15038* Southern California Aviation Council, Inc., Pasadena.
AIRSHIP CONSTRUCTION c05
John Roda *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 257-259 (For availability see N76-15015 06-01)
CSCL 01C

Forty-four years ago the first successful metal airship was completed and delivered to the United States Navy, the ZMC-2. Between those years and the present, very little effort or serious consideration has been given to the manufacture, design, construction, or economic impact of airships. It is important to retain and exploit the small but continually diminishing pool of

airship talent that will expedite the success of the United States in what is now a pioneering venture. The relative simplicity of airship construction, utilizing the tremendous technical advances of the last 44 years, leads to the conclusion that this form of transportation holds great promise for reducing costs of military missions and improving the international competitive position of the United States in commercial applications. Author

N76-15039* Aerling, Bedford, Ind.
OPERATIONAL CONSIDERATIONS FOR THE AIRSHIP IN SHORT-HAUL TRANSPORTATION c66
Charles D. Walker *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 261-266 refs (For availability see N76-15015 06-01)
CSCL 12B

The airship's problems and the possibilities for their solution in a short-haul transportation environment are surveyed. The problems are derived from both past experience and envisioned operation. Problems relative to both fully buoyant and semi-buoyant configurations are considered and their origins in principle discussed. Also addressed in this paper are the state-of-the-art technologies with the potential of providing answers to the airship's operational difficulties. Author

N76-15040* Maiersperger (Walter P.), Monterey, Calif.
DESIGN ASPECTS OF ZEPPELIN OPERATIONS FROM CASE HISTORIES c66
Walter P. Maiersperger *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 267-283 refs (For availability see N76-15015 06-01)
CSCL 12B

Some widely held beliefs concerning the practicability of rigid airships in air carrier operations are discussed. It is shown by a review of past operational experience, and some basic aerostatic theory, their actual record and the reasons for their demise. Problems of atmospheric density and temperature variations, meteorological factors, aerodynamic stability and control, and mooring difficulties are discussed and related to actual case histories. Structural and flight efficiencies are compared to airplane efficiencies for airplanes contemporary with the zeppelin as well as modern designs. The difficulty of supporting new, commercial airship developments on an economic basis is made clear. Author

N76-15041* California Dept. of Transportation, Sacramento.
LIGHTER THAN AIR: A LOOK AT THE PAST, A LOOK AT THE POSSIBILITIES c66
William F. Shea *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 285-295 refs (For availability see N76-15015 06-01)
CSCL 12B

A brief history of the flight by LTA including the development of the zeppelin is presented. Safety and economy are discussed along with power requirements and production techniques. The problem of ground handling facilities for very large airships are briefly mentioned. F.O.S.

N76-15042* Walker (Hepburn, Jr.), Vero Beach, Fla.
MOORING AND GROUND HANDLING RIGID AIRSHIPS c09
Hepburn Walker, Jr. *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 297-310 refs (For availability see N76-15015 06-01)
CSCL 01E

The problems of mooring and ground handling rigid airships are discussed. A brief history of Mooring and Ground Handling Rigid Airships from July 2, 1900 through September 1, 1939 is included. Also a brief history of ground handling developments with large U. S. Navy nonrigid airships between September 1, 1939 and August 31, 1962 is included wherein developed equipment and techniques appear applicable to future large rigid airships. Finally recommendations are made pertaining to equipment and procedures which appear desirable and feasible for future rigid airship programs. Author

N76-15043* Naval Air Systems Command, Washington, D.C.
A NEW CONCEPT FOR AIRSHIP MOORING AND GROUND HANDLING c09
John C. Vaughan *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 311-321 refs (For availability see N76-15015 06-01)
CSCL 01E

Calculations were made to determine the feasibility of applying the negative air cushion (NAC) principle to the mooring of airships. Pressures required for the inflation of the flexible trunks are not excessive and the maintenance of sufficient hold down force is possible in winds up to 50 knots. Fabric strength requirements for a typical NAC sized for a 10-million cubic foot airship were found to be approximately 200 lbs./in. Corresponding power requirements range between 66-HP and 5600-HP. No consideration was given to the internal airship loads caused by the use of a NAC and further analysis in much greater detail is required before this method could be applied to an actual design, however, the basic concept appears to be sound and no problem areas of a fundamental nature are apparent. Author

N76-15044* Slate All Metal Dirigible Co., Glendale, Calif.
THE SLATE ALL METAL AIRSHIP c05
Claude C. Slate and Richard D. Neumann (Southern Calif. Aviation Council, Inc.) *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 323-330 (For availability see N76-15015 06-01)
CSCL 01C

The development of the Slate all metal airship City of Glendale built and completed in 1930 is presented. The airship facilities are discussed. Pertinent data which led to other engineering accomplishments for aviation are shown. The SMD-100 concept is presented along with a brief commentary on the costs and problems involved in such an airship design and the application of the hoisting and elevator facilities to airship development. Author

N76-15045* Turbomachines, Inc., Irvine, Calif.
STATE OF THE ART OF METALCLAD AIRSHIPS c05
V. H. Pavlecka and John Roda *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 331-349 refs (For availability see N76-15015 06-01)
CSCL 01C

Metalclad airship development of the past history are considered along with the immediate prospects for continuation of the development of these airships. The metalclad airships promise high safety even in highly inclement weather, are capable of high speeds, while lifting high useful loads. Metalclad airships which in first cost would compare favorably with the costs of sea-going ships and in operating costs promise to be lower than airplanes. Author

N76-15046* Aerospace Developments, London (England).
THE AEROSPACE DEVELOPMENTS CONCEPT c05
John E. R. Wood *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 351-358 (For availability see N76-15015 06-01)
CSCL 01C

The viability of using airships for the transport of natural gas, and the initial design of such a system, the airship and its associated subsystems together with a continuing economic analysis of the project were investigated. Investigations, on a funded basis, were also carried out into the application of the airship for A.S.W. and A.E.W. uses, and a further investigation into the transport of mineral concentrates for an Australasian mining concern was completed. Author

N76-15047* Papst-Motoren KG, St. Georgen (West Germany).
METHOD FOR TRANSPORTING IMPELLENT GASES c03
Hermann Papst *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 359-367 (For availability see N76-15015 06-01)
CSCL 05C

The described system DAL comprises a method and a device for transportation of buoyant impellent gases, without the need for expensive pipes and liquid tankers. The gas is self air-lifted from its source to a consignment point by means of voluminous, light, hollow bodies. Upon release of the gas at the consignment point, the bodies are filled with another cheap buoyant gas (steam or heated air) for the return trip to the source. In both directions substantial quantities of supplementary freight

goods can be transported. Requirements and advantages are presented. Author

N76-15048* McMaster Univ., Hamilton (Ontario).
THE DESIGN AND CONSTRUCTION OF THE CAD-1 AIRSHIP **c05**
H. J. Kleiner, R. Schneider (Can. Airship Develop. Corp.), and J. L. Duncan *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 369-394 refs (For availability see N76-15015 06-01)
CSCL 01C

The background history, design philosophy and Computer application as related to the design of the envelope shape, stress calculations and flight trajectories of the CAD-1 airship, now under construction by Canadian Airship Development Corporation are reported. A three-phase proposal for future development of larger cargo carrying airships is included. Author

N76-15049* Goodyear Aerospace Corp., Akron, Ohio.
A LTA FLIGHT RESEARCH VEHICLE **c05**
Fred R. Nebiker *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 395-404 (For availability see N76-15015 06-01)
CSCL 01C

An Airship Flight Research Program is proposed. Major program objectives are summarized and a Modernized Navy ZPG3W Airship recommended as the flight test vehicle. The origin of the current interest in modern airship vehicles is briefly discussed and the major benefits resulting from the flight research program described. Airship configurations and specifications are included. Author

N76-15050* Airfloat Transport Ltd., Guildford (England).
THE AIRFLOAT HL PROJECT **c05**
Edwin Mowforth (Surrey Univ.) *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 405-414 (For availability see N76-15015 06-01)
CSCL 01C

A design study is described for a large low-cost rigid airship intended primarily for the movement of large indivisible loads (cargo) between industrial sites. A survey of the ship and its overall performance is followed by accounts of the operational procedures for the above function and for an alternative application to unit module transfer between fixed terminals. A final section indicates the estimated costs of construction and operation. Safety factors are also considered. Lifting devices such as winches, hoists are shown and described, and airship configurations are also shown. Author

N76-15051* United Technical Industries, El Segundo, Calif.
THE BASIC CHARACTERISTICS OF HYBRID AIRCRAFT **c05**
J. B. Nichols *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 415-430 refs (For availability see N76-15015 06-01)
CSCL 01C

The transportation of very heavy or very bulky loads by airships, and the ability to carry out extended duration flights at low speeds and low costs was studied. Structural design and weight factors for airship construction are examined. The densities of various light gases to be used in airships are given, along with their lifting capacities. The aerodynamic characteristics of various airship configurations was studied. Propulsion system requirements for airships are briefly considered. J.R.T.

N76-15052* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SEMIBUOYANT VEHICLE FOR GENERAL TRANSPORTATION MISSIONS **c05**
C. Dewey Havill and Michael Harper *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 431-439 (For availability see N76-15015 06-01)
CSCL 01C

The concept of a small, semibuoyant, lifting-body airship with either a disposable or nondisposable buoyant fluid is discussed. Estimations of fuel consumption, payload capability, power requirements and productivity are made and compared to other flight systems. Comparisons are made on the basis of equal cost vehicles. The assumption is made that, to a first-order approximation, the costs of developing, procuring, and operating a commercial air transport vehicle are proportional to vehicle empty weight. It must be noted that no historical cost data exist for the lifting-body airship and therefore these comparisons must be considered preliminary. Author

N76-15053* Aereon Corp., Princeton, N.J.
THE DYNAIRSHIP **c05**
William McElwee Miller, Jr. *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 441-455 (For availability see N76-15015 06-01)
CSCL 01C

A feasibility analysis for the construction and use of a combination airplane-airship named 'Dynairship' is undertaken. Payload capacities, fuel consumption, and the structural design of the craft are discussed and compared to a conventional commercial aircraft (a Boeing 747). Cost estimates of construction and operation of the craft are also discussed. The various uses of the craft are examined (i.e, in police work, materials handling, and ocean surveillance), and aerodynamic configurations and photographs are shown. J.R.T.

N76-15054* Flugwissenschaftliche Fachgruppe Goettingen e. V. (West Germany).
SOME ASPECTS OF HYBRID-ZEPPELINS **c05**
Paul-Armin Mackrodt *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 457-464 refs (For availability see N76-15015 06-01)
CSCL 01C

To increase an airship's maneuverability and payload capacity as well as to save bouyant gas it is proposed to outfit it with a slender delta-wing, which carries about one half of the total take-off weight of the vehicle. An optimization calculation based on the data of LZ 129 (the last airship, which saw passenger-service) leads to a Hybrid-Zeppelin with a wing of aspect-ratio 1.5 and 105 m span. The vehicle carries a payload of 40% of it's total take-off weight and consumes 0.8 t fuel per ton payload over a distance of 10000 km. Author

N76-15055* Piasecki Aircraft Corp., Philadelphia, Pa.
ULTRA-HEAVY VERTICAL LIFT SYSTEM: THE HELI-STAT **c05**
Frank N. Piasecki *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 465-476 refs (For availability see N76-15015 06-01)
CSCL 01C

A hybrid VTOL airship which is combined with helicopters is evaluated. The static lift of the airship supports approximately the full empty weight of the entire assembly. The helicopter rotors furnish the lift to support the payload as well as the propulsion and control about all axes. Thus existing helicopters, with no new technology required, can be made to lift payloads of ten times the capacity of each one alone, and considerably more than that of any airship built so far. A vehicle is described which has a 75-ton payload, based on four existing CH-53D helicopters and an airship of 3,600,000 cu. ft. The method of interconnection is described along with discussion of control, instrumentation, drive system and critical design conditions. The vertical lift and positioning capabilities of this vehicle far exceed any other means available today, yet can be built with a minimum of risk, development cost and time. Author

N76-15056* Dynapods, Inc., New Orleans, La.
THE VARIABLE DENSITY AIRCRAFT CONCEPT **c05**
A. C. Davenport *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 477-483 (For availability see N76-15015 06-01)
CSCL 01C

In the variable density aircraft concept the aircraft's density is varied by varying its volume. This is accomplished by combining a variable volume hull, which is called the dynapod, with intrinsic means for the controlled variation of a mass of working fluid or substance within the aircraft. The dynapod is a hinged structure and follows the volumetric variations of the working fluid. The result is a variable density hull, which with the attachment of power plants, etc., becomes a variable density aircraft. Author

N76-15057* International Bank for Reconstruction and Development, Washington, D.C.
ROLES OF AIRSHIPS IN ECONOMIC DEVELOPMENT c03
George J. Beier and Gerardo Cahn Hidalgo *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 485-498 refs (For availability see N76-15015 06-01)
CSCL 05C

It is proposed that airships of known and tested technology could, in some cases, perform routine transport missions more economically than conventional transport modes. If infrastructure for direct surface transport is already in place or if such infrastructure can be justified by the size of the market and there are no unusual impediments to constructing it, then the airships of tested technology cannot normally compete. If, however, the surface routes would be unusually expensive or circuitous, or if they involve several transhipments, or if the market size is too small to spread infrastructure costs of conventional transport, the airships of tested technology present a workable alternative. A series of special cases are considered. The cases, though unusual, are not unique; there are several similar possible applications which, in total, would provide a reasonably large market for airships. Author

N76-15058* Cranfield Inst. of Technology (England).
THE APPLICATION OF THE AIRSHIP TO REGIONS LACKING IN TRANSPORT INFRASTRUCTURE c03
Stephen Coughlin *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 499-507 ref (For availability see N76-15015 06-01)
CSCL 12B

The requirements for two areas of airship application are considered. The first of these are those countries where there is a need to move consignments that are too large for the existing transport systems; the second are those regions where ground characteristics have resulted in an area totally devoid of transport. The needs of the second group are considered in detail since they also require transport to provide social as well as economic growth. With this problem in mind, a philosophy is put forward for using airships in conjunction with LASH vessels. A specimen design is outlined and the initial costs estimated. Author

N76-15059* Hackney Associates, Sierra Madre, Calif.
AIRSHIP LOGISTICS: THE LTA VEHICLE; A TOTAL CARGO SYSTEM c03
L. R. Mike Hackney (Southern Calif. Aviation Council, Inc.) *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 531-538 refs (For availability see N76-15015 06-01)
CSCL 12B

Design considerations for logistics are dealt with as they pertain to the large rigid LTA vehicle as either a commercial or military cargo carrier. Pertinent factors discussed are: (1) the basic mission; (2) types of payload; (3) the payload space in regards to configuration and sizing, its capacity, and its loadability. A logistic capability comparison of selected cargo airships versus jumbo jets is also made. Author

N76-15060* Combustion Engineering, Inc., Windsor, Conn.
THE TRANSPORT OF NUCLEAR POWER PLANT COMPONENTS c03
S. J. Keating, Jr. *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 539-549 (For availability see N76-15015 06-01)
CSCL 12B

The problems of transporting nuclear power plant components to landlocked sites where the usual mode of transport by barge cannot be used are considered. Existing methods of ground-based overland transport are discussed and their costs presented. Components are described and traffic density projections made to the year 2000. Plots of units transported versus distance transported are provided for units booked in 1973 and booked and proposed in 1974. It is shown that, for these cases, overland transport requirements for the industry will be over 5,000,000 ton-miles/year while a projection based on increasing energy demands shows that this figure will increase significantly by the year 2000. The payload size, distances, and costs of existing overland modes are significant enough to consider development of a lighter than air (LTA) mode for transporting NSSS components. Author

N76-15061* Arkansas Univ., Fayetteville.
AIRSHIPS FOR TRANSPORTING HIGHLY VOLATILE COMMODITIES c03
Miles Sonstegaard *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 551-558 refs (For availability see N76-15015 06-01)
CSCL 12B

Large airships may prove feasible as carriers of commodities that move as gases or cryogenic liquids; buoyant gaseous cargo could be ballasted with liquid cargo. Airships are compact in shape, operate in a rarified medium, and hence can be fast and perhaps economic carriers of costly cryogenic tanks. The high-pressure gas pipeline has excessive surface area when carrying hydrogen and excessive fluid density when carrying natural gas, while the cryogenic ocean tanker runs in a dense medium and makes gravity waves. But the airship, despite its fluid dynamic advantages, faces problems of safety, weather, and altitude control. Author

N76-15062* Environic Foundation International, Notre Dame, Ind.
ENVIRONIC IMPLICATIONS OF LIGHTER THAN AIR TRANSPORTATION c03
Patrick Horsbrugh *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 563-570 refs (For availability see N76-15015 06-01)
CSCL 12B

The advent of any new system of transportation must now be reviewed in the physical context and texture of the landscape. Henceforward, all transportation systems will be considered in respect of their effects upon the environment to ensure that they afford an environic asset as well as provide an economic benefit. The obligations which now confront the buoyancy engineers are emphasized so that they may respond to these ethical and environic urgencies simultaneously with routine technical development. Author

N76-15063* Naval Air Systems Command, Washington, D.C.
AEROCRANE: A HYBRID LTA AIRCRAFT FOR AERIAL CRANE APPLICATIONS c05
Russel G. Perkins, Jr. and Donald B. Doolittle (All Am. Eng. Co.) *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 571-584 refs (For availability see N76-15015 06-01)
CSCL 01C

The Aerocrane, a hybrid aircraft, combines rotor lift with buoyant lift to offer VTOL load capability greatly in excess of helicopter technology while eliminating the airship problem of ballast transfer. In addition, the Aerocrane concept sharply reduces the mooring problem of airships and provides 360 deg vectorable thrust to supply a relatively large force component for control of gust loads. Designed for use in short range, ultra heavy lift missions, the Aerocrane operates in a performance envelope unsuitable for either helicopters or airships. Basic design considerations and potential problem areas of the concept are addressed. Author

N76-15064* Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
UNMANNED POWERED BALLOONS c05
Arthur O. Korn *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 585-594 refs (For availability see N76-15015 06-01)
CSCL 01C

In the late 1960's several governmental agencies sponsored efforts to develop unmanned, powered balloon systems for scientific experimentation and military operations. Some of the programs resulted in hardware and limited flight tests; others, to date, have not progressed beyond the paper study stage. Balloon system designs, materials, propulsion units and capabilities are briefly described, and critical problem areas are pointed out which require further study in order to achieve operational powered balloon systems capable of long duration flight at high altitudes. Author

N76-15065* Naval Ordnance Lab., White Oak, Md.
SPECIAL PROBLEMS AND CAPABILITIES OF HIGH ALTITUDE LIGHTER THAN AIR VEHICLES **c05**
P. R. Wessel and F. J. Petrone *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 595-603 refs (For availability see N76-15015 06-01)
CSCL 01C

Powered LTA vehicles have historically been limited to operations at low altitudes. Conditions exist which may enable a remotely piloted unit to be operated at an altitude near 70,000 feet. Such systems will be launched like high altitude balloons, operate like nonrigid airships, and have mission capabilities comparable to a low altitude stationary satellite. The limited lift available and the stratospheric environment impose special requirements on power systems, hull materials and payloads. Potential nonmilitary uses of the vehicle include communications relay, environmental monitoring and ship traffic control. Author

N76-15066* La Grue Volante, Chaville (France).
A PRACTICAL CONCEPT FOR POWERED OR TETHERED WEIGHT-LIFTING LTA VEHICLES **c05**
M. Alain Balleyguier *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 605-612 (For availability see N76-15015 06-01)
CSCL 01C

A concept for a multi-hull weightlifting airship is presented. The concept is based upon experience in the design and handling of gas-filled balloons for commercial purposes, it was first tested in April, 1972. In the flight test, two barrage balloons were joined side-by-side, with an intermediate frame, and launched in captive flight. The success of this flight test led to plans for a development program calling for a powered, piloted prototype, a follow-on 40 ton model, and a 400 ton transport model. All of these airships utilize a tetrehedric three-line tethering method for loading and unloading phases of flight, which bypasses many of the difficulties inherent in the handling of a conventional airship near the ground. Both initial and operating costs per ton of lift capability are significantly less for the subject design than for either helicopters or airships of conventional mono-hull design. Author

N76-15067* Sheldahl Co., Northfield, Minn. Tethered Aerostat Systems.
A REVOLUTIONARY AND OPERATIONAL TETHERED AEROSTAT SYSTEM ILLUSTRATING NEW LTA TECHNOLOGY **c05**
James A. Menke *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 613-622 (For availability see N76-15015 06-01)
CSCL 01C

An operational tethered aerostat system, which demonstrates utility of LTA systems, is described. It was made possible by development of a reliable tethered aerostat that is used to support broadcast equipment at an altitude of 10,000 feet. Two elements of the TCOM system, the aerostat and mooring station, are particularly relevant to the LTA Workshop. They demonstrate the feasibility of using LTA vehicles in real, operational, all-weather applications and, in addition, illustrate an advance in the overall technology base of LTA. The aerostat and the mooring station, including their technical design features and demonstrated performance characteristics, are described. Author

N76-15068* Sheldahl Co., Northfield, Minn. Structures and Materials Engineering.
TECHNOLOGY UPDATE: TETHERED AEROSTAT STRUCTURAL DESIGN AND MATERIAL DEVELOPMENTS **c05**
Robert G. Witherow *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 623-635 (For availability see N76-15015 06-01)
CSCL 01C

Requirements exist for an extremely stable, high performance, all-weather tethered aerostat system. This requirement has been satisfied by a 250,000 cubic foot captive buoyant vehicle as demonstrated by over a year of successful field operations. This achievement required significant advancements in several technology areas including composite materials design, aerostatics and aerodynamics, structural design, electro-mechanical design, vehicle fabrication and mooring operations. This paper specifically addresses the materials and structural design aspects of pressurized buoyant vehicles as related to the general class of Lighter Than Air vehicles. Author

N76-15069* Raven Industries, Inc., Sioux Falls, S.Dak.
TWO LIGHTER THAN AIR SYSTEMS IN OPPOSING FLIGHT REGIMES: AN UNMANNED SHORT HAUL, HEAVY LOAD TRANSPORT BALLOON AND A MANNED, LIGHT PAYLOAD AIRSHIP **c05**
R. A. Pohl *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 637-650 (For availability see N76-15015 06-01)
CSCL 01C

Lighter Than Air vehicles are generally defined or categorized by the shape of the balloon, payload capacity and operational flight regime. Two balloon systems that are classed as being in opposite categories are described. One is a cable guided, helium filled, short haul, heavy load transport Lighter Than Air system with a natural shaped envelope. The other is a manned, aerodynamic shaped airship which utilizes hot air as the buoyancy medium and is in the light payload class. While the airship is in the design/fabrication phase with flight tests scheduled for the latter part of 1974, the transport balloon system has been operational for some eight years. Author

N76-15070* Mosher Balloon Systems, Inc., Eugene, Ore.
BALLOON LOGGING WITH THE INVERTED SKYLINE **c05**
C. Frank Mosher *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 651-666 (For availability see N76-15015 06-01)
CSCL 01C

There is a gap in aerial logging techniques that has to be filled. The need for a simple, safe, sizeable system has to be developed before aerial logging will become effective and accepted in the logging industry. This paper presents such a system designed on simple principles with realistic cost and ecological benefits. Author

N76-15071* Military Sealift Command, Washington, D.C. Program Development Div.
LOTS OF LTA APPLICATIONS **c05**
Jay S. Brown *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 667-677 refs (For availability see N76-15015 06-01)
CSCL 01C

Current problems facing the logistical planner in utilizing the new ships of the modern, intermodal sea transportation systems in a logistics-over-the-shore (undeveloped) environment are described. Then the employment of two potential LTA vehicle systems are described and discussed as significant parts of possible solutions to this range of logistical problems. Vulnerability aspects of these LTA vehicles are also briefly addressed because of their possible employment near combat areas. Author

N76-15072* Developmental Sciences, Inc., City of Industry, Calif.
REMOTELY PILOTED LTA VEHICLE FOR SURVEILLANCE **c05**
Gerald R. Seemann, Gordon L. Harris, and Glen J. Brown *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 679-683 (For availability see N76-15015 06-01)
CSCL 01C

Various aspects of a remotely piloted mini-LTA vehicle for surveillance, monitoring and measurement for civilian and military applications are considered. Applications, operations and economics are discussed. Author

N76-15073* Southern California Aviation Council, Inc., Pasadena.
LTA BIBLIOGRAPHY **c82**
Richard D. Neumann *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 685-688 refs (For availability see N76-15015 06-01)
CSCL 05B

This bibliography includes publications which deal with airship design, engineering, stress calculations, and historical information. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-15074 Kansas Univ., Lawrence.
EXPERIMENTAL INVESTIGATION OF SEPARATED FLOW FIELDS ON AN AIRFOIL AT SUBSONIC SPEEDS Ph.D. Thesis
Hemmige Chintamani Seetharam 1975 119 p
Avail: Univ. Microfilms Order No. 76-1303

Detailed measurements of flow fields associated with low speed turbulent boundary layers were made for the 17% thick GA(W)-1 airfoil section. The data include extensive pressure and velocity surveys of the pre- and post-separated regions on the airfoil and the associated wake. The boundary layer characteristics including regions of separation of the airfoil are also presented. The results indicate steep gradients of displacement thickness, momentum thickness, and the separation streamline from the point of separation to the trailing edge of the airfoil. The tests reveal that the region of flow reversal terminates within a surprisingly short distance of less than 20% chord downstream from the trailing edge for the test range of angle of attack. A physical model for the separated turbulent boundary layer flow over the airfoil is proposed. Potential flow models are also proposed which may provide pressure distributions to initiate a complete potential-viscous flow computation of the separated flow over airfoils. Dissert. Abstr.

N76-15075 Iowa State Univ. of Science and Technology, Ames.
NUMERICAL COMPUTATION OF THREE-DIMENSIONAL BLUNT BODY FLOW FIELDS WITH AN IMPINGING SHOCK Ph.D. Thesis
Terry Lynn Holst 1975 168 p
Avail: Univ. Microfilms Order No. 76-1844

A time-marching finite-difference method was used to solve the compressible Navier-Stokes equations for the three-dimensional wing-leading-edge shock impingement problem. The bow shock was treated as a discontinuity across which the exact shock jump conditions were applied. All interior shock layer detail such as shear layers, shock waves, jets, and the wall boundary layer are automatically captured in the solution. The impinging shock was introduced by discontinuously changing the free-stream conditions across the intersection line at the bow shock. A special storage-saving procedure for sweeping through the finite-difference mesh was developed which reduces the required amount of computer storage by at least a factor of two without sacrificing the execution time. Numerical results are presented for infinite cylinder blunt body cases as well as the three-dimensional shock impingement case. The numerical results are compared with existing experimental and theoretical results. Dissert. Abstr.

N76-15076 Mississippi State Univ., State College.
CALCULATION AND ANALYSIS OF THE DEVELOPMENT OF THE TURBULENT BOUNDARY LAYER ON A THICK SYMMETRICAL ROTATING BODY OF LARGE SPAN Ph.D. Thesis
Lawrence J. Mertaugh, Jr. 1975 164 p
Avail: Univ. Microfilms Order No. 76-82

The development of the turbulent boundary layer over a rotating body such as a helicopter blade or other large aspect ratio propellers is analyzed. The role of the body thickness and the location of the axis of rotation in the development of the turbulent boundary layer is considered. A computer program developed to allow the needed calculations is described. Verification of the capabilities of the computer program are provided by comparisons of the computed results with selected sets of experimental data. The results justify the use of the computer program to analyze the turbulent boundary layer over a rotating body. The computer results for rotating bodies are provided for a rotating flat plate and a rotating elliptic cylinder with a thickness ratio of 0.5. Results show that the three-dimensional effects on a rotating body are small. The changes in the computed boundary layer characteristics due to changes in the location of the axis of rotation are also small. All of these three-dimensional effects increase with body thickness. Dissert. Abstr.

N76-15077*# Boston Univ., Mass. Dept. of Aerospace Engineering.
A NEW UNIFIED APPROACH TO ANALYZE WING-BODY-TAIL CONFIGURATIONS WITH CONTROL SURFACES IN STEADY, OSCILLATORY AND FULLY UNSTEADY, SUBSONIC AND SUPERSONIC FLOWS
Kadin Tseng and Luigi Morino [1975] 30 p refs
(Grant NGR-22-004-030)
(NASA-CR-146073) Avail: NTIS HC $4.00 CSCL 01A

A general formulation for the analysis of steady and unsteady, subsonic and supersonic potential aerodynamics for arbitrary complex geometries is presented. The theoretical formulation, the numerical procedure, and numerical results are included. In particular, generalized forces for fully unsteady (complex frequency) aerodynamics for an AGARD coplanar wing-tail interfering configuration in both subsonic and supersonic flows are considered. Author

N76-15078*# Boston Univ., Mass. Dept. of Aerospace Engineering.
FULLY UNSTEADY SUBSONIC AND SUPERSONIC POTENTIAL AERODYNAMICS FOR COMPLEX AIRCRAFT CONFIGURATIONS WITH APPLICATIONS TO FLUTTER
Kadin Tseng and Luigi Morino [1975] 31 p refs
(Grant NGR-22-004-030)
(NASA-CR-146067) Avail: NTIS HC $4.00 CSCL 01A

A general formulation is presented for the analysis of steady and unsteady, subsonic and supersonic aerodynamics for complex aircraft configurations. The theoretical formulation, the numerical procedure, the description of the program SOUSSA (steady, oscillatory and unsteady, subsonic and supersonic aerodynamics) and numerical results are included. In particular, generalized forces for fully unsteady (complex frequency) aerodynamics for a wing-body configuration, AGARD wing-tail interference in both subsonic and supersonic flows as well as flutter analysis results are included. The theoretical formulation is based upon an integral equation, which includes completely arbitrary motion. Steady and oscillatory aerodynamic flows are considered. Here small-amplitude, fully transient response in the time domain is considered. This yields the aerodynamic transfer function (Laplace transform of the fully unsteady operator) for frequency domain analysis. This is particularly convenient for the linear systems analysis of the whole aircraft. Author

N76-15079*# Boston Univ., Mass. Dept. of Aerospace and Mechanical Engineering.
A FINITE ELEMENT ANALYSIS OF THE EXACT NONLINEAR FORMULATION OF A LIFTING SURFACE IN STEADY INCOMPRESSIBLE FLOW, WITH THE EVALUATION OF THE CORRECT WAKE GEOMETRY M.S. Thesis
Emil O. Suciu 1975 119 p refs
(Grant NGR-22-004-030)
(NASA-CR-146074) Avail: NTIS HC $5.50 CSCL 01A

The problem of steady incompressible flow for lifting surfaces is considered. An integral equation is solved relating the values of the potential discontinuity on the lifting surface and its wake to the values of the normal derivative of the potential which are known from the boundary conditions. The lifting surface and the wake are divided into small quadrilateral surface elements. The values of the potential discontinuity and the normal derivative of the potential are assumed to be constant within each lifting surface element and equal to their values at the centroids of the lifting surface elements. This yields a set of linear algebraic equations. An iteration procedure is used to obtain the wake geometry: the velocities at the corner points of the wake elements are calculated and the wake streamlines are aligned to be parallel to the velocity vector. The procedure is repeated until convergence is attained. Author

N76-15080*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL AERODYNAMIC CHARACTERISTICS FOR SLENDER BODIES WITH THIN WINGS AT ANGLES OF ATTACK FROM 0 DEG TO 58 DEG AND MACH NUMBERS

FROM 0.6 TO 2.0
Leland H. Jorgensen and Michael H. Howell Washington Jan. 1976 127 p refs
(NASA-TM-X-3309; A-6150) Avail: NTIS HC $6.00 CSCL 01A

An experimental investigation was conducted in the Ames 6-by-6-Foot Wind Tunnel to measure the static aerodynamic characteristics for bodies of circular and elliptic cross section with various thin flat-plate wings. Eighteen configuration combinations were tested at Mach numbers of 0.6, 0.9, 1.2, 1.5, and 2.0 at angles of attack from 0 deg to 58 deg. The data demonstrate that taper ratio and aspect ratio had only small effect on the aerodynamic characteristics, especially at the higher angles of attack. Undesirable side forces and yawing moments, which developed at angles of attack greater than about 25 deg, were generally no greater than those for the bodies tested alone. As for the bodies alone, the side forces and yawing moments increased as the nose fineness ratio increased and/or as the subsonic Mach number decreased. Author

N76-15081*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC DYNAMIC STABILITY CHARACTERISTICS OF A SPACE SHUTTLE ORBITER
Delma C. Freeman, Jr., Richmond P. Boyden, and E. E. Davenport Washington Jan. 1976 165 p refs
(NASA-TN-D-8043; L-10063) Avail: NTIS HC $6.75 CSCL 01A

Supersonic forced-oscillation tests of a 0.0165-scale model of a modified 089B Rockwell International shuttle orbiter were conducted in a wind tunnel for several configurations over a Mach range from 1.6 to 4.63. The tests covered angles of attack up to 30 deg. The period and damping of the basic unaugmented vehicle were calculated along the entry trajectory using the measured damping results. Some parameter analysis was made with the measured dynamic derivatives. Photographs of the test configurations and test equipment are shown. Author

N76-15082*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE FORMULATION OF THE AERODYNAMIC CHARACTERISTICS IN AIRCRAFT DYNAMICS
Murray Tobak and Lewis B. Schiff Washington Jan. 1976 72 p refs Presented at lectures on Aircraft Stability and Control, Brussels, 12-16 May 1975
(NASA-TR-R-456; A-6008) Avail: NTIS HC $4.50 CSCL 01A

The theory of functionals is used to reformulate the notions of aerodynamic indicial functions and superposition. Integral forms for the aerodynamic response to arbitrary motions are derived that are free of dependence on a linearity assumption. Simplifications of the integral forms lead to practicable nonlinear generalizations of the linear superpositions and stability derivative formulations. Applied to arbitrary nonplanar motions, the generalization yields a form for the aerodynamic response that can be compounded of the contributions from a limited number of well-defined characteristic motions, in principle reproducible in the wind tunnel. Further generalizations that would enable the consideration of random fluctuations and multivalued aerodynamic responses are indicated. Author

N76-15083*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A REVIEW OF THE NASA V-G/VGH GENERAL AVIATION PROGRAM
Joseph W. Jewel, Jr. and Garland J. Morris Washington Dec. 1975 83 p refs
(NASA-TN-D-8058; L-10355) Avail: NTIS HC $5.00 CSCL 01A

The V-G and VGH data collected from a wide variety of general aviation airplanes since the inception of the NASA V-G/VGH General Aviation Program in 1962 are presented. These data were analyzed to obtain information on the gust and maneuver loads, on the operating practices, and on the effects of different types of operations on these parameters. Author

N76-15084*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF SEVERAL NACA 1-SERIES INLETS AT MACH NUMBERS FROM 0.4 TO 1.29 FOR MASS FLOW RATIOS NEAR 1.0
Richard J. Re Washington Dec. 1975 110 p refs
(NASA-TM-X-3324; L-10497) Avail: NTIS HC $5.50 CSCL 01A

An investigation to determine the performance of eight NACA 1-series inlets at massflow ratios near 1.0 was conducted in the Langley 16-foot transonic tunnel. The inlet diameter ratios (ratio of inlet diameter to maximum diameter) were 0.85 and 0.89 for an inlet length ratio (ratio of inlet length to maximum diameter) of 1.0. Inlet lip radius varied from 0.061 cm to 0.251 cm, and internal contraction area ratio (ratio of inlet area to throat area) varied from 1.006 to 1.201. Reynolds number based on model maximum diameter ranged from 3,600,000 at a Mach number of 400,000 to 5,900,000 at a Mach number of 1.29. The results indicate that nearly uniform pressure distributions on a given inlet were obtained over a limited range of mass-flow ratios and Mach numbers. When inlet lip thickness was increased by means of lip radius or contraction ratio, the inlet critical Mach number decreased. Drag-divergence Mach number inferred from forebody pressure integrations was above 0.94 for most of the inlets tested. Author

N76-15085*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A DEFLECTED-THRUST PROPULSIVE-LIFT TRANSPORT MODEL
Danny R. Hoad Washington Nov. 1975 185 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
(NASA-TM-X-3234; L-10106) Avail: NTIS HC $7.50 CSCL 01A

A wind-tunnel investigation was conducted to determine the effect of deflecting the engine exit of a four-engine double-slotted flap transport to provide STOL performance. Longitudinal aerodynamic data were obtained at various engine exit positions and deflections. The data were obtained at three flap deflections representing cruise, take-off, and landing conditions for a range of angles of attack and various thrust coefficients. Downwash angles at the location of the horizontal tail were measured. The data are presented without analysis or discussion. Photographs of the test configurations are shown. Author

N76-15086*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW SPEED WIND TUNNEL INVESTIGATION OF A FOUR-ENGINE UPPER SURFACE BLOWN MODEL HAVING SWEPT WING AND RECTANGULAR AND D-SHAPED EXHAUST NOZZLES
William C. Sleeman, Jr. and William C. Hohlweg (George Washington Univ.) Washington Dec. 1975 117 p refs
(NASA-TN-D-8061; L-10173) Avail: NTIS HC $5.50 CSCL 01A

A low speed investigation was conducted in the Langley V/STOL tunnel to determine the power-on static-turning and powered-lift aerodynamic performance of a four engine upper surface blown transport configuration. Initial tests with a D-shaped exhaust nozzle showed relatively poor flow-turning capability, and the D-nozzles were replaced by rectangular nozzles with a width-height ratio of 6.0. The high lift system consisted of a leading edge slat and two different trailing-edge-flap configurations. A double slotted flap with the gaps sealed was investigated and a simple radius flap was also tested. A maximum lift coefficient of approximately 9.3 was obtained for the model with the rectangular exhaust nozzles with both the double slotted flap deflected 50 deg and the radius flap deflected 90 deg. Author

N76-15087*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW SPEED WIND TUNNEL INVESTIGATION OF SPAN LOAD ALTERATION, FORWARD-LOCATED SPOILERS, AND SPLINES AS TRAILING-VORTEX-HAZARD ALLEVIATION DEVICES ON A TRANSPORT AIRCRAFT MODEL
Delwin R. Croom and R. Earl Dunham, Jr. Washington Dec. 1975 47 p refs
(NASA-TN-D-8133; L-10568) Avail: NTIS HC $4.00 CSCL 01A

The effectiveness of a forward-located spoiler, a spline, and span load alteration due to a flap configuration change as trailing-vortex-hazard alleviation methods was investigated. For the transport aircraft model in the normal approach configuration, the results indicate that either a forward-located spoiler or a spline is effective in reducing the trailing-vortex hazard. The results also indicate that large changes in span loading, due to retraction of the outboard flap, may be an effective method of reducing the trailing-vortex hazard. Author

N76-15088*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF A POWERED, EXTERNALLY BLOWN FLAP STOL TRANSPORT MODEL WITH TWO ENGINE SIMULATOR SIZES

William G. Johnson, Jr. Washington Nov. 1975 292 p refs (NASA-TN-D-8057; L-10129) Avail: NTIS HC $9.25 CSCL 01A

The low-speed aerodynamic characteristics are investigated of a general research model - a swept-wing, jet-powered STOL transport with externally blown flaps. The model was tested with four-engine simulators mounted on pylons under the 9.3-percent-thick supercritical airfoil wing. Two sets of air ejectors were used to provide data with large and small engines. Tests were conducted in the Langley V/STOL tunnel over an angle-of-attack range of -4 deg to 22 deg and a thrust-coefficient range from 0 to approximately 4. The effects are described of power, wing leading-edge slat configuration, T-tail and low horizontal-tail positions, and double-slotted flap deflection. Additional untrimmed and trimmed engine-out data and tail-body data are included. Author

N76-15089*# Chrysler Corp., New Orleans, La. Space Div.

MATED AERODYNAMIC CHARACTERISTICS INVESTIGATION FOR 0.04-SCALE MODEL BOEING 747 CAM/EXTERNAL TANK (MODEL AX1284 E-5) COMBINATION IN THE UNIVERSITY OF WASHINGTON AERONAUTICAL LABORATORY F. K. KIRSTEN WIND TUNNEL (CA11)

Nov. 1975 337 p Prepared in cooperation with Boeing Co., Seattle

(Contract NAS9-13247)

(NASA-CR-141835; DMS-DR-2236) Avail: NTIS HC $10.00 CSCL 01A

Experimental investigations of the aerodynamic characteristics of a 0.04-scale external tank (ET) force model in combination with a 0.04-scale Boeing 747 force model were conducted. Test purposes were: (1) to determine ET airloads for selected configurations and (2) to determine the effectiveness of ET position, incidence, and support structure and 747 vertical stabilizing surfaces on stability, control, and performance of 747/ET combinations. The 747 was tested alone to establish baseline data and to verify test results. Six-component aerodynamic force and moment data were recorded for the 747 CAM and ET combination. Six-component force and moment data were also recorded for the ET, which was mounted on an internal balance supported by the 747. Data were recorded for angles of attack from -4 deg to +24 deg in 2 deg increments and angles of sideslip of - deg to + or - 20 deg. Testing was conducted at Mach 0.15 with dynamic pressure deg at 36 psf and unit Reynolds number of 1.3 million per foot. Photographs of test configurations are shown. Author

N76-15090# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

NON-LINEAR DYNAMIC-MOTION CHARACTERISTICS OF A SERIES OF MISSILE CONFIGURATIONS FROM SIMULATED FLIGHT BEHAVIOUR AT MACH NUMBERS OF 1.6 AND 2.0

I. M. Titchener London Aeron. Res. Council 1975 63 p refs Supersedes RAE-TR-73145; ARC-35185

(ARC-R/M-3764; RAE-TR-73145; ARC-35185) Avail: NTIS HC $4.50; HMSO £3.50; PHI $13.57

Models of a series of related missile configurations representative of current trends in design of maneuverable missiles were tested in a dynamic simulator to determine the damped free oscillatory response to a range of prescribed settings of the controls. Nonlinear oscillatory-motion histories measured in a wind tunnel/flight dynamics simulator are analyzed. The resulting dynamic-motion characteristics for large-amplitude motions in the pitch plane are discussed in relation to the aerodynamic features of the various configurations tested, and a simple dimensionless mathematical model is specified. Author (ESA)

N76-15091# Imperial Coll. of Science and Technology, London (England).

CALCULATIONS OF THE STEADY CONICAL FLOW PAST A YAWED SLENDER DELTA WING WITH LEADING-EDGE SEPARATION

D. I. Pullin London Aeron. Res. Council 1975 49 p refs Supersedes ARC-33963

(ARC-R/M-3767; ARC-33963) Avail: NTIS HC $4.00; HMSC £3.90; PHI $15.12

The vortex-sheet model of leading-edge separation is extended to the calculation of steady conical flow past a yawed slender delta wing. Introducing yaw destroys the symmetry property inherent in the unyawed problem necessitating that the two leading-edge vortex sheets be treated as independent but mutually interacting singularity distributions in the cross-flow plane of the slender-body theory. From the calculations, predictions are obtained of the variation of the principal quantitative flow characteristics - including the two primary vortex core positions and the wing rolling-moment coefficient - with the incidence and yaw parameters. Comparison of these predictions with experimental data is reasonable qualitatively but only fair quantitatively, the discrepancies being attributed to the neglect, in the flow model, of the effects of the secondary separation system on the windward side of the wing. The range of the present calculations is to some extent limited by failure of the solution technique at lower values of the incidence parameter. Author (ESA)

N76-15092# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

MEASUREMENTS OF THE THREE-DIMENSIONAL INCOMPRESSIBLE TURBULENT BOUNDARY LAYER INDUCED ON THE SURFACE OF A SLENDER DELTA WING BY THE LEADING-EDGE VORTEX

L. F. East London Aeron. Res. Council 1975 63 p refs Supersedes RAE-TR-73141; ARC-35269

(ARC-R/M-3768; RAE-TR-73141; ARC-35269) Avail: NTIS HC $4.50; HMSO £3.26; PHI $12.60

Data obtained in the three-dimensional turbulent boundary layer on the upper, lifting surface of a large half-delta model at incidence are presented. The flow studied approximates closely conic conditions and consequently the quantity of data required to define it is not as great as it would be in a general three-dimensional flow. The flow just outside the boundary layer is shown to be in fair agreement with a published inviscid theory for conic flows about lifting bodies. The boundary layer data are restricted to mean flow properties measured with conventional pitot and static probes. The shear stress profiles are derived from the mean flow data by the use of the momentum equations. Although of rather limited accuracy this analysis adds further support to the very limited published evidence that in general the Reynolds stress is not parallel to the velocity gradient. Author (ESA)

N76-15093# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

THE APPLICATION OF A SURFACE FLOW-VISUALISATION TECHNIQUE IN FLIGHT

P. L. Bisgood London Aeron. Res. Council 1975 21 p refs Supersedes RAE-TR-74022; ARC-35554

(ARC-R/M-3769; RAE-TR-74022; ARC-35554) Avail: NTIS HC $3.50; HMSO £1.10; PHI $4.30

Some exploratory experiments on flight adaptation of the oil-flow technique of visualizing the flow, to a slender-wing research aircraft HP-115 are described. The results obtained are discussed and a comparison made with wind tunnel measurements. The technique yielded repeatable results which, when compared with data from other sources, indicated that the visualizations achieved were valid. Author (ESA)

N76-15094# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

MEASUREMENTS OF OSCILLATORY AERODYNAMIC HINGE MOMENTS FROM THE RESPONSE OF A WIND TUNNEL MODEL TO TURBULENT FLOW

G. B. Hutton, D. A. Drane, and D. R. Gaukroger London Aeron. Res. Council 1975 19 p refs Supersedes RAE-TR-73130-Rev; ARC-35231

(ARC-CP-1317; RAE-TR-73130-Rev; ARC-35231) Avail: NTIS HC $3.50; HMSO 50p; PHI $2.15

Control surface hinge moment derivatives were evaluated from analysis of the response of a wind tunnel model to turbulence in the tunnel flow and these were compared with derivatives obtained from steady state oscillatory measurements on the same model. The comparison shows that the basic dynamic data (natural frequency and damping) obtained from both techniques are in close agreement. However small differences in the data lead to rather larger differences in the value of the aerodynamic derivatives. ESA

N76-15095# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE EXTERNAL-FLOW, JET-AUGMENTED FLAP

P. R. Ashill London Aeron. Res. Council 1975 52 p refs Presented at the AGARD Propulsion and Energetics Conf., Schliersee, Ger., Sep. 1973 Supersedes RAE-TR-74089;ARC-35650

(ARC-CP-1319; RAE-TR-74089; ARC-35650) Avail: NTIS HC $4.50; HMSO £1.20; PHI $4.90

A semi-empirical method for predicting the jet deflection angle and the thrust recovery factor, i.e. the factor that is applied to the momentum flux leaving the exit of the engine nacelle to allow for turning and spreading losses is described. The method is based on an analysis of a series of tests performed on a wing, body, and injector-powered nacelle under static conditions. The formulae derived from the analysis are combined with a theory, which is based on the jet-flap analogy, to provide estimates of the forces and moments acting on wings with external flow, jet-augmented flaps in forward flight. Comparisons are made between this method and wind-tunnel data obtained.

Author (ESA)

N76-15096# Societe Europeenne de Propulsion, Bordeaux (France).

THEORETICAL AND EXPERIMENTAL FLOW STUDIES AROUND AN INTEGRATED NOZZLE FOR SOLID PROPELLANT ROCKET ENGINES [ETUDES THEORIQUES ET EXPERIMENTALES DE L'ECOULEMENT AUTOUR D'UNE TUYERE INTEGREE D'UN PROPULSEUR A POUDRE]

Jacques Coste (ONERA), Jean Ovadia, and Jean Rona Paris Assoc. Aeron. et Astronautique de France 1975 42 p refs In FRENCH Presented at the 11th Assoc. Aeron. et Astronautique de France Colloq. d'Aerodyn. Appl., Bordeaux, 6-8 Nov. 1974 Sponsored by Direc. Tech. des Engins

(AAAF-NT-75-1; ISBN-2-7170-0319-3) Avail: NTIS HC $4.00; CEDOCAR, Paris FF 25 (France and ECC) FF 29 (others)

A theoretical and experimental study of the optimum propergol geometry for integrated rocket nozzles is presented. The computation based on the Spalding finite difference integration method of a subsonic, viscous rotational and compressible flow is compared to the results of pressure measurements on the walls and at the nozzle convergent together with an axial probing for determining the sonic line at the trough and the velocity profile. Performance differences were evidenced due to various propergol internal geometries and integration positions within the combustion chamber. ESA

N76-15097# Engins Matra, Velizy (France).

ROCKET NOZZLE THRUST VECTOR CONTROL BY REATTACHMENT ON CURVED WALLS [CONTROLE DU VECTEUR POUSSEE D'UNE TUYERE PAR RECOLLEMENT SUR PAROIS COURBES]

R. Katz and M. Lepretre (Soc. Bertin et Cie., Plaisir, France) Paris Assoc. Aeron. et Astronautique de France 1975 26 p refs In FRENCH Sponsored by Direc. des Rech. et Moyens d'Essais

(AAAF-NT-75-3; ISBN-2-7170-0321-5) Avail: NTIS HC $4.00; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

The coanda effect was used to control the thrust vector of a rocket engine at the power stage of the control stage. A convergent-divergent nozzle for solid propellant rocket was used. The parameter range, pressure measurement, and display services are detailed together with performance criteria. The commutation problems including command fluid consumption, maximum commutation frequency, and static and dynamic tests, are detailed. The geometry of the blowing slot of the set deviator was investigated. Actual tests on a specific engine were carried out. ESA

N76-15098# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).

EXPERIMENTAL DETERMINATION OF THE CHARACTERISTICS OF ABLATIVE MATERIALS BY PLASMA JETS [CARACTERISATION EXPERIMENTALE DE MATERIAUX ABLATABLES PAR JET DE PLASMA]

Maxime Labrot Paris Assoc. Aeron. et Astronautique de France 1975 27 p In FRENCH Presented at the 11th Assoc. Aeron. et Astronautique de France Colloq. d'Aerodyn. Appl., Bordeaux, 6 - 8 Nov. 1974

(AAAF-NT-75-4; ISBN-2-7170-0322-3) Avail: NTIS HC $4.00; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

The performances of various plasma generators to test the thermal protective materials of a space vehicle during atmospheric reentry were investigated. The principal physical and chemical phenomena occurring during the ablation process are reviewed. Present operational plasma generators are briefly described as well as their performances for different material test configurations such as the square tube method, inclined plate method, and cone test method. Measurements during the materials tests at the generator level and at the material level are discussed. It is shown that the plasma generators are suitable for testing the thermal control coatings of a space vehicle during atmospheric reentry. The hot gas generation use is emphasized. ESA

N76-15099# Association Aeronautique et Astronautique de France, Paris.

PERFORMANCE OPTIMIZATION AND AERODYNAMICS OF PROPULSIVE AND SUSTAINING SYSTEMS IN CYCLIC MODE [AERODYNAMIQUE DES SYSTEMES PORTANTS ET PROPULSIFS EN REGIME DE FONCTIONNEMENT PERIODIQUE OPTIMISATION DE LEURS PERFORMANCES]

G. Coulmy, T. S. Luu, and L. Malavard 1975 76 p refs In FRENCH

(AAAF-NT-75-5; ISBN-2-7170-0323-1) Avail: NTIS HC $5.00; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

A unified theory of propulsive/sustaining systems is presented using the vorticity theory for sustentating surfaces under unsteady flow. Optimum functioning was found to correspond to a Newmann type boundary condition for velocity potential both in stationary and unsteady flight. The numerical method used takes advantage of discretized distribution of singularities from which performance and yield indices are derived. The inverse problem of the deformation to be given to the surface in order that the required law be satisfied was carried out by the singularity method. Applications to lifting rotors, oscillatory wings, and rotary wings, were investigated. ESA

N76-15100# Societe Europeenne de Propulsion, Bordeaux (France).

BIPHASE BIDIMENSIONAL FLOW IN THE TRANSONIC ZONE OF PROPULSIVE NOZZLES [CONTRIBUTION A L'ETUDE DES ECOULEMENTS BIDIMENSIONNELS DIPHASIQUES DANS LA ZONE TRANSSONIQUE DES TUYERES PROPULSIVES]

L. J. Jacques Paris Assoc. Aeron. et Astronautique de France 1975 36 p refs In FRENCH

(AAAF-NT-75-6; ISBN-2-7170-0324-X) Avail: NTIS HC $4.00; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

A new computing method for biphasic bidimensional flow in the transonic zone of an axisymmetric nozzle is presented. First order quasilinear partial derivative equations were used for iterative numerical calculations, based on the model of equivalent gas at equilibrium. A decoupling between the gaseous phase and condensed phase is thus obtained at each iteration step. Use of the compatibility condition associated with the sonic line allows finding the following results: the mass flow is basically

dependent on the nozzle convergent part; the main parameters to consider are the particle size and nozzle geometry at the trough; a separate treatment may be used in the mixed phase zone and in the particle free zones at the walls; to obtain reliable values for supersonic calculation by the method of characteristics both convergent and divergent parts of the nozzle are to be considered. ESA

N76-15101# Lyon Univ. (France). Lab. de Mecanique des fluides.

SECONDARY FLOW IN AXISYMMETRIC COMPRESSORS [ECOULEMENTS SECONDAIRES DANS LES COMPRESSEURS AXIAUX]

R. Flot, K. Papailiou, and J. Mathieu Paris Assoc. Aeron. et Astronautique de France 1975 88 p refs In FRENCH Sponsored by Direc. des Rech. et Moyens d'Essais

(AAAF-NT-75-7; ISBN-2-7170-0325-8) Avail: NTIS HC $5.00; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

The results of three experiments aimed at determining secondary flows in compressor walls by simulation of the flow through impellers is presented. An analysis and comparison with existing theories were performed. The longitudinal velocity profile is described by bidimensional flow while the transversal velocity profile trend can be evaluated only by present theories. The wall flow seems to follow three-dimensional theory results. ESA

N76-15102# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

TRIDIMENSIONAL LINEARIZED SUPERSONIC FLOW COMPUTATIONS [CALCULS D'ECOULEMENTS TRIDIMENSIONNELS EN SUPERSONIQUE LINEARISE]

P. Schein Paris Assoc. Aeron. et Astronautique de France 1975 51 p refs In FRENCH

(AAAF-NT-75-17; ISBN-2-7170-0335-5) Avail: NTIS HC $4.50; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

The method of finite differences is applied to tridimensional linearized supersonic flow computations for the case of fuselage-engine integration at air inlet distortion level. The basic equations, approximation, and linearization procedures are reviewed. The discretization process, boundary conditions, and stability conditions are detailed, and the computation flow diagram is outlined. Results are compared with actual experiments. ESA

N76-15103# Societe Nationale Industrielle Aerospatiale, Paris (France).

ROTOR AERODYNAMICS. WAKE EQUILIBRATING [AERODYNAMIQUE DES ROTORS. MISE EN EQUILIBRE DU SILLAGE]

B. Courjaret Assoc. Aeron. et Astronautique de France 1975 27 p refs In FRENCH Presented at the 11th Assoc. Aeron. et Astronautique de France Colloq. d-Aerodyn. Appl., Boreaux, 6-8 Nov. 1974 Sponsored by Direc. de Rech. des Moyens d'Essais

(AAAF-NT-75-18; ISBN-2-7170-0336-3) Avail: NTIS HC $4.00; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

The equilibrium of a turbulent wake for a rotor in axial translational motion was used to obtain a better theoretical prevision of the local working point incidences. The advantages of the method are shown to increase with specific rotor loading corresponding to a significant shrinkage of the turbulent zone. The solution of the integral equations is outlined, and the results give the wake shape, and the velocity distribution along the rotor blade. ESA

N76-15104# Societe Nationale Industrielle Aerospatiale, Paris (France).

ON THE COMPUTATION OF TWO-DIMENSIONAL TRANSONIC FLOW WITH BOUNDARY LAYER [CALCULS BIDIMENSIONNELS TRANSSONIQUES AVEC COUCHE LIMITE]

J. Bousquet Assoc. Aeron. et Astronautique de France 1975 34 p refs In FRENCH

(AAAF-NT-75-20; ISBN-2-7170-0340-1) Avail: NTIS HC $4.00; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

To solve the discrepancy between the results from perfect fluid transonic computations and experiments relating to pressure distribution in shock presence, a method taking into account the viscous effects in the computation of two-dimensional transonic flow with boundary layer was developed. The Garabedian-Korn perfect fluid method is presented and its validity limits in the presence of shocks are discussed. The influence of viscosity on the shock intensity as well as on the boundary layer displacement was investigated theoretically and applied to transonic flow over lifting airfoils. The reliability of this computation method is emphasized and its integration into a supercritical wing computerized simulation line is presented. ESA

N76-15105# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).

STUDY OF INTERACTION PHENOMENA BETWEEN NORMAL SHOCK WAVES AND TURBULENT BOUNDARY LAYER FOR TRANSONIC TURBOMACHINERY APPLICATIONS [ETUDE DE PHENOMENES D'INTERACTION ONDE DE CHOC NORMALE - COUCHE LIMITE TURBULENTE EN VUE DES APPLICATIONS AUX TURBOMACHINES TRANSONIQUES]

R. Leblanc and R. Goethals Paris Assoc. Aeron. et Astronautique de France 1975 109 p refs In FRENCH

(Contract DGRST-73/130)

(AAAF-NT-75-21; ISBN-2-7170-0339-8) Avail: NTIS HC $5.50; CEDOCAR, Paris FF 25 (FRANCE and EEC) FF 29 (others)

Three configurations of normal shock wave/turbulent boundary layer interaction at M = 1.43 and M-1.75 in a 65 x 65 sq mm wind tunnel and at M = 1.43 in a 150 x 150 sq mm wind tunnel were investigated for transonic turbomachinery applications. The different methods for the supersonic flow blocking by normal shocks are presented. They include blocking by second neck effect, by shock generator, and by the Mach effect. Flow analysis methods such as schlieren photography, wall flow visualization, and wall pressure measurements, as well as boundary layer pressure (total and static) measurements are described. Three-dimensional and unsteady flow effects are analyzed. The Seddon model for normal shock wave/turbulent boundary layer interaction is reviewed. Results from experiments and those predicted by the seddon model are correlated, discussed, and applied to turbomachinery. Flow geometry at M = 1.75 and M = 1.43 and interaction configurations are described. ESA

N76-15106# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

A WIND TUNNEL TEST OF SYMMETRIC LOADS ON TWO WING-BODY COMBINATIONS AT MACH NUMBERS 4 AND 7 Final Report

Erik Larson 1975 65 p refs

(Contract INK-11-12-73197)

(FFA-TN-AU-636) Avail: NTIS HC $4.50

The forces in the symmetry plane on two wingbody combinations and on the body alone were measured at low angles of attack by a watercooled balance at Mach numbers 4 and 7. An attempt was made to inspect and overcome some of the difficulties in predicting component loads on wing-body combinations by short-cut methods at small to medium high angles of attack, less than 15 deg. The usefulness of the slender body theory together with the cross flow and Newtonian theory in the preparation of this kind of short-cut method is however perhaps not yet fully exploited. Author (ESA)

N76-15107# Cranfield Inst. of Technology (England). Aerodynamics Div.

SUPERSONIC TURBULENT BOUNDARY LAYERS: SOME COMPARISONS BETWEEN EXPERIMENT AND SIMPLE THEORY

J. L. Stollery Aug. 1975 20 p refs

(Cranfield-Aero-7510) Avail: NTIS HC $3.50

Comparisons are made between measurements of skin friction and heat transfer over five axisymmetric bodies and the predictions of a simple theory. The development of the theory is outlined and explicit expressions obtained for all the gross turbulent boundary layer characteristics, such as form factor, displacement thickness ratio, momentum thickness ratio, skin friction coefficient, heat transfer coefficient, are calculated. Author (ESA)

N76-15108# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

WIND TUNNEL TEST TECHNIQUES FOR THE MEASURE-

MENT OF UNSTEADY AIRLOADS ON OSCILLATING LIFTING SYSTEMS AND FULL-SPAN MODELS
Hans Foersching 30 Jul. 1975 53 p refs Presented at the Discussion on Unsteady Aerodyn. at the AGARD Fluid Dyn. Panel Meeting, Goettingen, West Ger., 27-30 May 1975
(DLR-FB-75-51) Avail: NTIS HC $4.50; DFVLR, Cologne DM 25

Wind tunnel test techniques for the measurement of unsteady airloads on oscillating lifting systems and full-span models are briefly discussed. The basic principles of measurement, general guidelines of model design and test instrumentation, and other important features for the measurement of dynamic stability derivatives, flutter coefficients and unsteady pressure distributions are described and illustrated with some typical test results.
Author (ESA)

N76-15109# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Rettungs- und Bergungssysteme.
THEORETICAL INVESTIGATION OF THE FILLING PROCESS OF A FLEXIBLE PARACHUTE-PAYLOAD SYSTEM Ph.D. Thesis - Tech. Univ. Brunswick
Kuang-Hua Fu Aug. 1975 123 p refs In GERMAN; ENGLISH summary
(DLR-FB-75-56) Avail: NTIS HC $5.50; DFVLR, Cologne DM 51.20

The behavior of a flexible parachute-payload system during the filling process and the following transition to a quasi-steady state was investigated for plane motion. A method was developed with which the parachute performance data (opening shock force, filling time, and speed of payload at the completion of filling) can be calculated for optional system parameter values and initial values. Further, the influence was investigated of modeling and geometric parameters as well as that of the initial values on the parachute performance data. It is shown that the load factor first increases with increasing mass ratio, attains a maximum and then decreases. The load factor increases linearly with increasing Froude number; the amount of increase depends on the mass ratio. Author (ESA)

N76-15110# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
UNSTEADY PRESSURES ON A HARMONICALLY OSCILLATING, STAGGERED CASCADE. PART 1: INCOMPRESSIBLE FLOW
Hermann Triebstein, Volker Carstens, and Joachim Wagener 1 Sep. 1975 70 p refs In GERMAN; ENGLISH summary Report will also be announced as translation 2 Vol.
(DLR-FB-75-57-Pt-1) Avail: NTIS HC $4.50; DFVLR, Cologne DM 32.70

Measurements of unsteady airloads on harmonically oscillating cascade airfoils are discussed. Special emphasis is given to the test technique and the test set-up. The measurements were performed in the cascade-windtunnel of the DFVLR-AVA at Goettingen on a plate-like staggered cascade consisting of seven plates at harmonically pitching oscillations about two different pitching axes, and at flapping oscillations of both the whole cascade and one flat plate only. The measurements were performed at zero angle of attack, at a stagger angle of 60 deg, and at a Mach number of 0.2; the oscillation frequencies were 10, 30 and 70 cps thus yielding reduced frequencies from 0.04 to 0.26 and a Reynolds number of 340,000. Some of the test results were critically compared with corresponding theoretical results. For part 2; see N76-15111. Author (ESA)

N76-15111# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
UNSTEADY PRESSURES ON A HARMONICALLY OSCILLATING, STAGGERED CASCADE. PART 2: COMPRESSIBLE FLOW
Hermann Triebstein, Volker Carstens, and Joachim Wagener 30 Jul. 1975 90 p refs In GERMAN; ENGLISH summary Report will also be announced as translation 2 Vol.
(DLR-FB-75-58-Pt-2) Avail: NTIS HC $5.00; DFVLR, Cologne DM 41.60

Measurements of unsteady airloads on harmonically oscillating cascade airfoils are discussed. Special emphasis is given to the test technique and the test set-up. The measurements were performed in the cascade-windtunnel of the DFVLR-AVA at Goettingen on a plate-like staggered cascade consisting of seven plates at harmonically pitching oscillations about two different pitching axes, and at flapping oscillations of both the whole cascade and one flat plate only. The measurements were performed at zero angle of attack at a stagger angle of 60 deg and at Mach numbers 0.4 and 0.6; the oscillation frequencies were 10, 30 and 70 cps thus yielding frequencies of 0.012 to 0.126 and Reynolds numbers 720,000 and 1,080,000. Some of the test results were critically compared with corresponding theoretical results. Author (ESA)

N76-15112# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
SOLUTION OF EULER EQUATIONS FOR THREE-DIMENSIONAL SUPERSONIC FLOWS AROUND BLUNT BODIES Ph.D. Thesis - Tech. Hochschule Aachen
Claus Weiland 7 Oct. 1975 97 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-60) Avail: NTIS HC $5.00; DFVLR, Cologne DM 36.10

Flow fields of ideal inviscid gases with free stream Mach numbers greater than 1 around blunt bodies were calculated. The integration of the Euler equations was conducted with the difference algorithm developed by Lyubimow and Rusanow. Particular attention was paid to flow fields with free stream Mach numbers slightly larger than 1, because these are not very often treated in the literature up to now. In order to attenuate the large computing times, which occur especially for flow fields with transonic free stream Mach numbers, an investigation of the numerical stability was made, using the method of small oscillations. The result made it possible to derive a new time-step method. Author (ESA)

N76-15113# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
COMPARISON OF SLENDER CHANNEL COMPUTATIONS WITH EXPERIMENTS FOR LOW REYNOLDS NUMBER HYPERSONIC NOZZLE FLOWS Final Report
Nimai Kumar Mitra and Martin Fiebig 17 Sep. 1975 79 p refs Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-75-64) Avail: NTIS HC $5.00; DFVLR, Cologne DM 31.80

High enthalpy low Reynolds number hypersonic nozzle flows were numerically investigated and the results were compared with available experimental data. Solutions were obtained under various experimental conditions for argon and nitrogen flows. Pitot pressure, local mass flow rate, total enthalpy, velocity, static temperature and Mach number profiles were calculated. Comparison with experimental results at the nozzle exit shows in general good agreement. Comparison of theory and experiments shows also that the usual method to determine the stagnation temperature from measured total mass flow rate and stagnation pressure, using the assumption of one dimensional inviscid flow to the throat leads to errors of up to 20 % in the stagnation temperature. Author (ESA)

N76-15114# European Space Agency, Paris (France).
FIVE-COMPONENT MEASUREMENTS ON THE MBB REENTRY VEHICLE AT HYPERSONIC MACH NUMBERS AND SMALL REYNOLDS NUMBERS
K.-A. Buetefisch et al Oct. 1975 45 p refs Transl. into ENGLISH of "Fuenfkomponenten-Messungen am MBB-Raumflugkoerper bei hypersonischen Machzahlen u. kleinen Reynoldszahlen", DFVLR, Goettingen, West Ger. Report DLR-FB-73-49, Jan. 1973 Original German report available from DFVLR, Porz, West Ger. 14.10 DM
(ESA-TT-199; DLR-FB-73-49) Avail: NTIS HC $4.00

In the hypersonic low density wind tunnel of the DFVLR-AVA, the aerodynamic coefficients of drag, lift, side-force,pitching, and yawing moment of a special model were measured at Mach numbers of 12 and 20 and at Reynolds numbers between 2,000 and 19,000 using a strain gage balance. The influence of flap deflection and the behavior at high angles of attack were also studied. Author (ESA)

N76-15115# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
INVESTIGATION OF SIDE FORCES ON OGIVE-CYLINDER BODIES AT HIGH ANGLES OF ATTACK IN THE M EQUALS 0.5 TO 1.1 RANGE Final Report
George S. Pick Apr. 1975 25 p refs Repr. from AIAA Paper 71-570 Presented at 4th Fluid and Plasma Dynamics Conf., Palo Alto, Calif., Jun. 1971
(AD-A014420; ASED-1200; NSRDC-4633) Avail: NTIS CSCL 20/4

Side force measurements, involving ogive-cylinder bodies with systematically varied nose fineness and bluntness ratios, are presented for laminar and turbulent boundary layers. Results indicate that the side force remains small below 25 deg angle of attack and increases to a maximum value at around 35 deg to 40 deg depending on Mach number and geometry. The magnitude of side force increases with increasing fineness ratio, and decreases with large nose blunting. Strong dynamic effects and sensitivity to small geometric variations are evident. In all test conditions the measured side force is significantly reduced when the boundary layer is turbulent. GRA

N76-15116# ARO, Inc., Arnold Air Force Station, Tenn.
AXIAL-FORCE MEASUREMENTS ON CONE CYLINDERS MOUNTED IN A SIMULATED AEROBALLISTIC RANGE TRACK IN TUNNEL F WITH APPLICATION TO A FULL-SCALE SYSTEM Final Report, 1 Jun. 1974 - 20 Jan. 1975
David E. Boylan Aug. 1975 66 p refs Sponsored by AF
(ARO Proj. V31S-36A)
(AD-A013793; ARO-VKF-TR-75-31; AEDC-TR-75-78) Avail: NTIS CSCL 16/2

Axial-force measurements on cone-cylinder models mounted in a simulated aeroballistic range model restraining track system are presented. The data were obtained in the range 15.4 equal to or less than M equal to or less than 19.2 at Reynolds numbers between 0.29 and 1.08 x 1,000,000 per foot. An analytical technique based on inviscid conical flow-field solutions and the experimental data was used to develop an empirical method for estimating the contribution to the model drag from interaction of the model bow shock on the track system and its subsequent reflections back onto the model surface. It is shown that about 15 to 40 percent of total vehicle drag (neglecting sliding friction between the model and the track rails) will be from this shock interaction contribution. Important parameters are cone angle, nose bluntness, model velocity, track dimensions, and range pressure. Calculations are performed over the expected envelope of operation for a full-scale test facility. GRA

N76-15117# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
SEPARATION AHEAD OF CONTROLS ON SWEPT WINGS Interim Report, Apr. 1973 - Apr. 1975
Louis G. Kaufman, II and L. Michael Freeman Jun. 1975 53 p refs
(AF Proj. 7064)
(AD-A014240; ARL-75-0134) Avail: NTIS CSCL 01/3

Shock-induced flow-separation ahead of trailing edge controls on swept wings is investigated with emphasis on the effects of boundary layer transition on the location and shape of the separation line. Experimental results were obtained by using forward facing steps mounted on swept-leading-edge flat-plate wing models in the ARL Mach 6 Tunnel for model running length Reynolds numbers varying from 0.9 to 33 million. The data support qualitatively a proposed, strip-type method for estimating, the extent and shape of the three dimensional region of separated flow ahead of controls on swept wings.
Author (GRA)

N76-15118# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOVIET NUCLEAR BLIMPS
31 Jul. 1975 7 p Transl. into ENGLISH from Aeronautica (Italy), v. 19, no. 9, 15 Mar. 1974 p 3
(AD-A014310; FTD-ID(RS)I-1637-75) Avail: NTIS CSCL 01/3

Reports concerning a Soviet atomic propelled blimp are briefly discussed. The blimp is capable of carrying 1800 passengers at a cruising speed of 300 km. Author

N76-15119# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME AERODYNAMIC PROBLEMS RAISED BY THE AIRSHIP
Louis Cabot 22 Jul. 1975 26 p Transl. into ENGLISH from Off. Nat. Etud. Rech. Aerosp. Note Tech. (Chatillon), no. 1312, 1973 p 1-15
(AD-A014401; FTD-ID(RS)I-1618-75) Avail: NTIS CSCL 01/1

After recalling the aerodynamic peculiarities of the free and the tethered balloon, the paper gives a survey of the airship aerodynamic characteristics, as recorded on old machines (especially the Akron), in wind tunnel and in flight. The unstable nature of the airframes is emphasized, as well as the associated piloting problem. GRA

N76-15030* Woodward (Donald E.), Alexandria, Va.
AN AERODYNAMIC LOAD CRITERION FOR AIRSHIPS
Donald E. Woodward *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 169-176 refs (For availability see N76-15015 06-01)
CSCL 01A

N76-15031* Naval Ordnance Lab., White Oak, Md.
THE PLANAR DYNAMICS OF AIRSHIPS
Frank J. Regan *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 177-186 refs (For availability see N76-15015 06-01)
CSCL 01A

N76-15033* McMaster Univ., Hamilton (Ontario).
LONG FLUID FILLED BAGS SUSPENDED BY LINE FORCES
M. L. Mullins and J. L. Duncan *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 199-208 refs Sponsored in part by Natl. Res. Council of Canada (For availability see N76-15015 06-01)
CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-15120# Mitre Corp., McLean, Va.
AN ACTIVE BEACON-BASED COLLISION AVOIDANCE SYSTEM CONCEPT (BCAS), ADDENDUM 1 Final Report
L. Schuchman Oct. 1975 38 p
(Contract DOT-FA70WA-2448)
(AD-A017102/5; MTR-7036; FAA-EM-75-7-Add-1) Avail: NTIS HC $4.00 CSCL 01/2

The concept of an active beacon collision avoidance system (BCAS) is described. The design constraints of this air-to-air collision avoidance system are given, together with the system design which enables BCAS to minimize the critical problem of garble. Results from a dynamic aircraft traffic model simulation are presented and finally the possible extensions of BCAS to high density airspace and to a DABS/IPC environment are discussed. Author

N76-15121# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE LOGAN MLS MULTIPATH EXPERIMENT
D. A. Shnidman 23 Sep. 1975 89 p refs
(Contracts DOT-FA74WAI-461; F19628-76-C-0002)
(AD-A017083/7; ATC-55; FAA-RD-75-130) Avail: NTIS HC $5.00 CSCL 01/5

The plan for a microwave landing system specifies a carrier frequency for the system in the vicinity of 5.1 GHz. At that frequency, no multipath data taken at a major civilian airport existed. The purpose of this experiment was to obtain such data at Logan International Airport in order to ascertain: (1) which objects are the major causes of measurable multipath

reflections and their level relative to the direct signal (M/D level), (2) whether or not the reflections from these objects can be satisfactorily simulated by the Lincoln computer model and, if so, how complicated must that model be, and (3) if the characteristics of multipath provide a significant discriminant between the Doppler and scanning beam techniques. It was found in the experiment that regions where reflections were noted could be predicted from ray optics and diffraction. No measurable reflections were noted elsewhere. For the purpose of modeling for multipath, building surfaces could be characterized as a flat plate with a reflection coefficient determined by measurement if it were a complicated surface, or by the dielectric properties of the surface material, if a simple surface. The airplane reflection model was also found to agree well with measurements. Author

N76-15122# National Aviation Facilities Experimental Center, Atlantic City, N.J.

CHARACTERISTICS OF HALON 1301 DISPENSING SYSTEMS FOR AIRCRAFT CABIN FIRE PROTECTION Final Report, Jan. - Nov. 1973

Constantine P. Sarkos Sep. 1975 126 p refs

(FAA Proj. 181-521-020)

(AD-A017061/3; FAA-NA-74-59; FAA-RD-75-105) Avail: NTIS HC $5.50 CSCL 01/3

The two Halon 1301 dispensing systems, modular nozzle and perforated tube, were designed and installed in an obsolete but completely furnished CD7 passenger cabin. For each system, agent distribution was continuously measured during discharge and for a period of 10 minutes at approximately 20 locations throughout the unpressurized cabin. The effect of Halon 1301 discharge on cabin temperature, noise, pressure, and visibility was also measured. The modular system was judged to be best by virture of its producing more rapid and effective agent distribution resulting in greater potential fire-protection capability. Installation of the Halon 1301 dispensers along the ceiling for both systems minimized the known possible transient adverse effects upon passengers from agent concentration overshoot, discharge noise, overpressure, and reduced temperature. Halon 1301 was found to rapidly permeate all cabin airspaces, including those shielded from the discharge streamlines. The effect of agent leakage through opened emergency exits was investigated. It was determined that even under such unfavorable conditions of operation, a high-rate discharge system would provide a reasonably good degree of inerting protection over a representative evacuation period. Author

N76-15123# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

GENERIC AIRBORNE FIRE SUPPRESSION SYSTEM Final Technical Report, Dec. 1970 - Jun. 1973

William J. McNamara Wright-Patterson AFB, Ohio DOD Aircraft Ground Fire Suppression and Rescue Office May 1975 70 p

(AD-A014226; DOD-AGFSRS-75-2) Avail: NTIS CSCL 13/12

This report describes the development, design, fabrication, installation and testing of a generic airborne fire suppression system. This was an experimental device specifically designed to permit inflight operation for testing and evaluation of suppressing and/or extinguishing aircraft crash ground fires from a hovering UH-1H helicopter. GRA

N76-15124# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT/INCIDENT REPORTS: BRIEF FORMAT, SUPPLEMENTAL ISSUE 1974

27 Jun. 1975 124 p

(PB-244115/2; NTSB-BA-75-3) Avail: NTIS HC $5.50 CSCL 01B

Reports are given of aircraft accidents and incidents that occurred in 1974 and have not been included in a prior issue of briefs. Included are three U.S. air carrier accidents, 28 U.S. air carrier incidents, 99 U.S. general aviation accidents, and 38 U.S. general aviation incidents. Four foreign air carrier accidents, one foreign air carrier incident, and 12 foreign general aviation accidents that were investigated by the National Transportation Safety Board are also included. GRA

N76-15125# Dayton Univ. Research Inst., Ohio.

AIRFIELD PARAMETER STUDY AND CATEGORIZATION SYSTEM RELATED TO AIRCRAFT GROUND FIRE SUPPRESSION AND RESCUE Final Report

David J. Iden and Jerry B. Reeves Jun. 1975 125 p refs

(Contract F33657-72-C-0491)

(AD-A014225; DOD-AGFSRS-75-1) Avail: NTIS CSCL 13/12

This report presents a discussion of the characteristics of airfields/helicopter pads which are related to the aircraft ground fire suppression and rescue (AGFSR) operation at DoD installations. The basic elements of the AGFSR system are described and a plan for rating airfields/helicopter pads according to their AGFSR needs is presented. The principal factor in the system is the maximum representative fuel fire area which is a direct function of aircraft fuel capacity. GRA

N76-15126# Naval Aerospace Medical Research Lab., Pensacola, Fla.

ORIENTATION-ERROR ACCIDENTS IN REGULAR ARMY UH-1 AIRCRAFT DURING FISCAL YEAR 1971: RELATIVE INCIDENCE AND COST

W. Carroll Hixson and Emil Spezia 11 Jun. 1975 36 p refs Sponsored in part by Army Aeromedical Res. Lab., Fort Rucker, Ala.

(MF51524005)

(AD-A014423; NAMRL-1218; USAARL-75-21) Avail: NTIS CSCL 01/2

The report is the fifth in a longitudinal series of reports dealing with the magnitude of the pilot disorientation/vertigo accident problem in Regular Army UH-1 helicopter operations. Incidence and cost data presented for fiscal year 1971 include a total of 31 major and minor orientation-error accidents (15 of which were fatal), resulting in 44 fatalities, 52 nonfatal injuries, and a total UH-1 aircraft damage cost of $6,337,446. GRA

N76-15127# Payne, Inc., Annapolis, Md.

EXTENDED MEASUREMENTS OF AERODYNAMIC STABILITY AND LIMB DISLODGEMENT FORCES WITH THE ACES-2 EJECTION SEAT Final Report, 1 Nov. 1973 - 31 Jan. 1975

Fred W. Hawker and Anthony J. Euler Wright-Patterson AFB, Ohio AMRL Jul. 1975 95 p refs

(Contract F33615-74-C-4015; AF Proj. 7231)

(AD-A014432; Working-Paper-119-11; AMRL-TR-75-15) Avail: NTIS CSCL 01/3

The ACES-2 seat was mounted in a wind tunnel in various attitudes of pitch and yaw. The hand and foot rests were equipped with means to measure limb dislodgement forces. Overall forces and moments were measured at the seat mount. Human subjects were used as seat occupants for gross force and moment data on the seat/occupant combination, as well as limb dislodgement force measurements. Anthropomorphic dummies were used for an extended range of yaw angles around to 180 degrees. Only gross force and moment data for the seat/occupant combination were taken with the dummy subjects. The limb dislodgement results are complementary to earlier tests at low pitch angles and show general reductions in magnitude as the pitch angle is increased. GRA

N76-15128# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

LISTING OF AIRCRAFT ACCIDENTS/INCIDENTS BY MAKE AND MODEL. US CIVIL AVIATION 1973

18 Jun. 1975 178 p

(PB-244520/3; NTSB-AMM-75-1) Avail: NTIS HC $7.50 CSCL 01B

The publication contains a listing of all U.S. civil aviation accidents/incidents occurring in CY 1973, sorted by aircraft make and model. Included are the file number, aircraft registration number, date and location of the accident, aircraft make and model and injury index for all 4,405 accidents/incidents occurring in this period. GRA

N76-15129# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

BRIEFS OF ACCIDENTS INVOLVING MIDAIR COLLISIONS. US GENERAL AVIATION 1973

18 Jun. 1975 43 p
(PB-244521/1; NTSB-AMM-75-2) Avail: NTIS HC $4.00 CSCL 01B

Included are 24 accident files, 12 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by kind of flying, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N76-15130# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING TURBINE POWERED AIRCRAFT. US GENERAL AVIATION 1973
18 Jun. 1975 74 p
(PB-244522/9; NTSB-AMM-75-3) Avail: NTIS HC $4.50 CSCL 01B

Included are 102 accident briefs, 24 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and cause/factor(s). GRA

N76-15131# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING ROTORCRAFT. US GENERAL AVIATION 1973
18 Jun. 1975 150 p
(PB-244523/7; NTSB-AMM-75-4) Avail: NTIS CSCL 01B

Reports of U.S. General Aviation Rotorcraft accidents occurring in 1973 are presented. Included are 277 accident briefs, 28 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N76-15132# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF FATAL ACCIDENTS INVOLVING WEATHER AS A CAUSE/FACTOR: US GENERAL AVIATION 1973
18 Jun. 1975 275 p
(PB-244524/5; NTSB-AMM-75-5) Avail: NTIS HC $9.00 CSCL 01B

The publication contains reports of all fatal U.S. general aviation accidents involving weather as a cause/factor for the year 1973. Included are 272 fatal accidents in the brief format. This format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated on all accidents involving weather as a cause/factor by the type of accident, phase of operation, injury index, aircraft damage, pilot's certificate, injuries and cause/factor(s). GRA

N76-15133# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING ALCOHOL AS A CAUSE/FACTOR. US GENERAL AVIATION 1973
18 Jun. 1975 34 p
(PB-244525/2; NTSB-AMM-75-6) Avail: NTIS HC $4.00 CSCL 01B

General Aviation accidents, occurring in 1973, involving alcohol impairment as a cause/factor are reported. The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N76-15134# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING MISSING AND MISSING LATER RECOVERED AIRCRAFT. US GENERAL AVIATION 1973
18 Jun. 1975 95 p
(PB-244526/0; NTSB-AMM-75-7) Avail: NTIS HC $5.00 CSCL 01B

General aviation missing and missing later recovered accidents occurring in 1973 are reported. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N76-15135# National Transportation Safety Board, Washington, D.C.
BRIEFS OF ACCIDENTS INVOLVING CORPORATE/EXECUTIVE AIRCRAFT. US GENERAL AVIATION 1973
18 Jun. 1975 69 p
(PB-244527/8; NTSB-AMM-75-8) Avail: NTIS HC $4.50 CSCL 01B

Reports of U.S. general aviation corporate/executive aircraft accidents occurring in 1973 are reported. Included are 94 accident Briefs, 24 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injuries and causal/factor(s). GRA.

N76-15136# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING AMATEUR/HOME BUILT AIRCRAFT. US GENERAL AVIATION 1973
18 Jun. 1975 71 p
(PB-244528/6; NTSB-AMM-75-9) Avail: NTIS HC $4.50 CSCL 01B

The publication contains reports of U.S. general aviation accidents involving amateur/home built aircraft occurring in 1973. Included are 116 accident Briefs, 30 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable cause(s)/factors(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal/factor(s). GRA

N76-15137# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING AIR TAXI OPERATIONS. US GENERAL AVIATION 1973
18 Jun. 1975 114 p
(PB-244529/4; NTSB-AMM-75-10) Avail: NTIS HC $5.50 CSCL 01B

General aviation air taxi accidents occurring in 1973 are reported. The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal/factors(s). GRA

N76-15138# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING AERIAL APPLICATION OPERATIONS. US GENERAL AVIATION 1973
18 Jun. 1975 266 p
(PB-244530/2; NTSB-AMM-75-11) Avail: NTIS HC $9.00 CSCL 01B

General aviation aerial application accidents occurring in 1973. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal/factor(s). GRA

N76-15047* Papst-Motoren KG, St. Georgen (West Germany).
METHOD FOR TRANSPORTING IMPELLENT GASES
Hermann Papst *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 359-367 (For availability see N76-15015 06-01)
CSCL 05C

N76-15057* International Bank for Reconstruction and Development, Washington, D.C.
ROLES OF AIRSHIPS IN ECONOMIC DEVELOPMENT
George J. Beier and Gerardo Cahn Hidalgo *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan.

1975 p 485-498 refs (For availability see N76-15015 06-01)
CSCL 05C

N76-15058* Cranfield Inst. of Technology (England).
THE APPLICATION OF THE AIRSHIP TO REGIONS LACKING IN TRANSPORT INFRASTRUCTURE
Stephen Coughlin *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 499-507 ref (For availability see N76-15015 06-01)
CSCL 12B

N76-15059* Hackney Associates, Sierra Madre, Calif.
AIRSHIP LOGISTICS: THE LTA VEHICLE; A TOTAL CARGO SYSTEM
L. R. Mike Hackney (Southern Calif. Aviation Council, Inc.) *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 531-538 refs (For availability see N76-15015 06-01)
CSCL 12B

N76-15060* Combustion Engineering, Inc., Windsor, Conn.
THE TRANSPORT OF NUCLEAR POWER PLANT COMPONENTS
S. J. Keating, Jr. *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 539-549 (For availability see N76-15015 06-01)
CSCL 12B

N76-15061* Arkansas Univ., Fayetteville.
AIRSHIPS FOR TRANSPORTING HIGHLY VOLATILE COMMODITIES
Miles Sonstegaard *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 551-558 refs (For availability see N76-15015 06-01)
CSCL 12B

N76-15062* Environic Foundation International, Notre Dame, Ind.
ENVIRONIC IMPLICATIONS OF LIGHTER THAN AIR TRANSPORTATION
Patrick Horsbrugh *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 563-570 refs (For availability see N76-15015 06-01)
CSCL 12B

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-15139# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ENROUTE SECTOR REDESIGN (FIELD SURVEY OF FLIGHT STRIP DATA) Interim Report, Apr. 1974 - Mar. 1975
Richard L. Sulzer and Robert J. Lucas Sep. 1975 27 p
(AD-A016665/2; FAA-NA-75-26; FAA-RD-75-138) Avail: NTIS HC $3.75 CSCL 17/7

A flight data survey was conducted at eight air route traffic control centers to identify sector flight data requirements when operating with National Airspace System Stage A radar data processing (RDP). Controllers stated which flight data elements, presently shown on paper flight strips, are required for continuous display when using RDP, and which elements can be deleted from display or placed on a callup status in a redesigned enroute sector. The results of this survey and a concomitant analysis of hand annotation of control information on the strips are intended to guide design of a testable and improved display that can replace the paper strips. Procedures to be followed in demonstrating the potential utility of such a reformatted and automated display of flight data are summarized. Also, tests to be conducted with improved data input facilities are described. Author

N76-15140*# Sperry Flight Systems, Phoenix, Ariz.
DEVELOPMENT OF THE NASA VALT DIGITAL NAVIGATION SYSTEM
Walter J. McConnell, Jr., Edmund R. Skutecki, and Alfonso J. Calzado [1975] 160 p
(Contract NAS1-12365)
(NASA-CR-144894) Avail: NTIS HC $6.75 CSCL 17G

The research to develop and fabricate a terminal area navigation system for use in the NASA VTOL Approach and Landing Technology (VALT) program. The results of that effort are reported. The navigation system developed and fabricated was based on a general purpose airborne digital computer. A set of flight hardware units was fabricated to create the necessary analog, digital and human interface with the computer. A comprehensive package of software was created to implement the control and guidance laws required for automatic and flight director approaches that are curved in two planes. A technique was developed that enables the generation of randomly shaped lateral paths from simple input data. The lateral path concept combines straight line and elliptical-curved segments to fit a continuous curved path to the data points. A simple, fixed base simulation was put together to assist in developing and evaluating the system. The simulation was used to obtain system performance data during simulated curved-path approaches. Author

N76-15141# National Aviation Facilities Experimental Center, Atlantic City, N.J.
NATIONAL AIRSPACE SYSTEM: MEASURING AIR ROUTE TRAFFIC CONTROL CENTER COMPUTER UTILIZATION Final Report, Apr. 1974 - Apr. 1975
Michael J. McCrory Apr. 1975 110 p
(AD-A017492/0; FAA-RD-75-171) Avail: NTIS HC$5.50 CSCL 17/7

Data collected from the Air Route Traffic Control Centers within the United States to determine the available computer processing time for National Airspace System automation programs are presented. Methods used as well as the conclusions derived from the survey are given. Author

N76-15142# Test Group (6585th), Holloman AFB, N.Mex. Central Inertial Guidance Test Facility.
PROCEEDINGS OF THE 7TH BIENNIAL GUIDANCE TEST SYMPOSIUM, VOLUME 1
May 1975 875 p refs Symp. held at AF Spec. Weapons Center, Holloman AFB, N. Mex., 14-16 May 1975
(AD-A013916; AFSWC-TR-75-26-Vol-1) Avail: NTIS CSCL 17/7

These proceedings contain papers included in the Seventh Biennial Guidance Test Symposium. This symposium, hosted by the Central Inertial Guidance Test Facility, is directed toward the exchange of information, stimulation of new ideas, and discussion of recent developments in the field of guidance testing. The papers presented in these proceedings include such topics as aircraft inertial navigators, strapped-down guidance systems, component evaluation, and analysis techniques. The included papers were those presented in the unclassified session of the symposium. GRA

N76-15143# Transportation Systems Center, Cambridge, Mass.
ADVANCED AIR TRAFFIC MANAGEMENT SYSTEM STUDY OVERVIEW Final Report, 1 Jul. 1973 - 30 Jun. 1975
Jun. 1975 58 p refs
(PB-243460/3; DOT-TSC-OST-75-32) Avail: NTIS HC $4.50 CSCL 17G

This report summarizes the U.S. Department of Transportation study and development plans for the air traffic management system of the late 1980's and beyond. The plans are presented in the framework of an evolutionary system concept of traffic management, building upon the upgraded third generation air traffic control system, and defined to meet the projected demands for service, safety, and flexibility in a cost effective manner. In order to provide the information needed for planning future system developments, a program of research and development is described for the system concept presented. GRA

N76-15144# Analytic Sciences Corp., Reading, Mass.
FREE-INERTIAL AND DAMPED-INERTIAL NAVIGATION MECHANIZATION AND ERROR EQUATIONS Technical Report, 20 Aug. 1973 - 20 Aug. 1974
Warren G. Heller 18 Apr. 1975 58 p refs
(AD-A014356; TASC-TR-312-1-1) Avail: NTIS CSCL 17/7

The equations that describe both the navigation mechanization and the propagation of errors in an unaided inertial system are detailed. Extensions of these equations which apply to continuous speed and altitude damping are also given. A general vector-matrix notation is employed, thereby eliminating the need to specify a particular navigation mechanization before setting down the error equations. Specific application of the general equations to the local-level, wander-azimuth mechanization is outlined. The detailed form of the error equations is given for both the free-inertial case and various choices of continuous damping. GRA

N76-15145# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE EFFECTS OF STABILITY AUGMENTATION ON THE GUST RESPONSE OF A STOL AIRCRAFT DURING A CURVED MANUAL APPROACH Ph.D. Thesis Final Report, Jun. 1971 - May 1975
Milton B. Porter Jun. 1975 228 p refs
(AF Proj. 8219; AF Proj. 1986)
(AD-A014301; AFFDL-TR-75-63) Avail: NTIS CSCL 20/4

The multiple precision approach paths which are possible with microwave landing systems pose new lateral separation problems for the simultaneous optimum curved approach trajectories. Separation criteria for these new multiple paths will be influenced by aircraft path tracking performance. Manually piloted STOL aircraft will be particularly sensitive to atmospheric turbulence during precision tracking. In this study a parametric variation of the open loop poles of a STOL aircraft was made using stability augmentation system (SAS) gains, and the gust response of the manually piloted aircraft was analyzed at points on an MLS approach path. The study was reduced to two quadratic optimal control problems for linear infinite time stochastic systems: (1) to compute the SAS gains using a rate-model-in-the-performance-index pole placement algorithm, and (2) to calculate the pilot gains and system gust response using a quadratic optimal pilot model. Both the SAS and pilot gains calculation yielded reasonable low gains for all cases, and the four lateral-directional poles and the longitudinal short period poles could be placed accurately. The most significant improvement in lateral error was achieved by increasing roll stability. The variation in lateral path error with bank angle was also significant and the nature of the variation was strongly influenced by the specific augmented poles. There was a conflict between good conventional flying qualities and optimum gust response since increased dutch roll frequency yielded the greatest reduction in the objectionable lateral and directional mode cross coupling while increasing the lateral gust response error. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-15146# Advisory Group for Aerospace Research and Development, Paris (France).
HANDLING QUALITIES SPECIFICATION DEFICIENCIES
A. G. Barnes Nov. 1975 23 p refs
(AGARD-AR-89) Avail: NTIS HC $3.50

A summary is presented on the contributions received from NATO nations on the deficiencies of six different handling qualities specifications. They are: Mil-H-8501, Mil-F-8785-B, TSS-3, Mil-F-83300, AR 577, AvP 970. The purpose was to determine those portions of the various handling qualities specifications which were inadequate or overly restrictive. The result shows that there were not a great many severe deficiencies, and those that were found were not entirely unexpected. The collected comments illustrate the difficulty of collecting information from design or certification authorities which quantifies flying qualities. Difficulties arise because the information needed to compare an early aircraft design with a current specification is often not available; also there is a reluctance to publicize information which might show a particular aircraft in a bad light. The need for further research is shown. Author

N76-15147# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
COMPARISON OF WIND TUNNEL TESTS AND FLIGHT TESTS OF AN EXECUTIVE AIRCRAFT [COMPARAISON DES ESSAIS EN SOUFFLERIE ET DES ESSAIS EN VOL POUR UN AVION EXECUTIVE]
J. Maestrati Paris Assoc. Aeron. et Astronautique de France 1975 24 p In FRENCH
(AAAF-NT-75-14; ISBN-2-7170-0332-0) Avail: NTIS HC $3.50; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Wind tunnel tests and flight tests of the Falcon business aircraft were compared. The direct method involves comparing the unitary curves obtained from the two tests, whereas the indirect method consists of establishing from the wind tunnel tests a basic set of adjusted parameters which are converted into the same time based parameters recorded on flight test tapes, using flight mechanic equations and a simulation program. The comparison of the two methods is presented, and the results of longitudinal and lateral tests are discussed. ESA

N76-15148# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
CHANGES IN HELICOPTER RELIABILITY/MAINTAINABILITY CHARACTERISTICS OVER TIME. VOLUME 1: BASIC REPORT Final Report
Norman J. Asher, John Donelson, and Gerald F. Higgins Mar. 1975 307 p refs 2 Vol.
(Contract DAHC15-73-C-0200)
(AD-A014469; S-451-Vol-1; IDA/HQ-75-17098-Vol-1) Avail: NTIS CSCL 01/3

This two volume report examines the growth (or lack of it) in reliability and maintainability (R and M) characteristics of past helicopter programs and organizes the data so that they can be used as bases for predicting the R and M characteristics of future helicopter programs. Six types of R and M data are presented: (1) failure rates, (2) component-removal rates, (3) mishap rates, (4) maintenance-action rates, (5) operational availability, and (6) maintenance man-hours. Volume one also contains much data on past helicopter programs so that they will be available for use by analysts. GRA

N76-15149# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
CHANGES IN HELICOPTER RELIABILITY/MAINTAINABILITY CHARACTERISTICS OVER TIME. VOLUME 2: DATA SUBMITTED BY HELICOPTER MANUFACTURERS Final Report
Norman J. Asher, John Donelson, and Gerald F. Higgins Mar. 1975 323 p 2 Vol.
(Contract DAHC15-73-C-0200)
(AD-A014470; S-451-Vol-2; IDA/HQ-75-17099-Vol-2) Avail: NTIS CSCL 01/3

The second volume of a two-volume report on helicopter performance and maintenance contains data from three aircraft manufacturers on reliability and maintainability (R and M). Much of the information is in graphic and tabular form. Monthly and summary statistics are given, directed toward predicting the R and M characteristics of future helicopter programs. GRA

N76-15150# Marine Corps, Washington, D.C.
DA APPROVED SMALL DEVELOPMENT REQUIREMENT FOR A FAMILY OF EXTERNAL HELICOPTER SLINGS, 5,000 TO 60,000 POUND CAPACITY
25 Jul. 1975 18 p
(AD-A014430; MCO-3900.4A) Avail: NTIS CSCL 01/3

The report describes the requirements, purpose and operational characteristics of a helicopter sling. GRA

N76-15151# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FATIGUE AND AIRPLANES

Bu Chen 24 Jul. 1975 16 p Transl. into ENGLISH from Hang Kung Chih Shih (Chinese People's Republic), no. 5, 1974 p 12-15
(AD-A014308; FTD-ID(RS)I-1602-75) Avail: NTIS CSCL 01/3

Fatigue failure due to cyclic loads is discussed in terms of crack propagation. Preventive measures by aircraft design, and fatigue tests are described. F.O.S.

N76-15152# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MONOGRAPHY
Jiri Moravec 22 Jul. 1975 34 p Transl. into ENGLISH from Letectivi-Kosmonautika (Czechoslovakia), no. 22, 1974 p 24/864-30/870
(AD-A014304; FTD-ID(RS)I-1518-75) Avail: NTIS CSCL 01/3

The translation gives a brief technical description with a few drawings and operational data of the Russian MIG-17 aircraft. GRA

N76-15153# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THE DEVELOPMENT OF A TWO-DIMENSIONAL, HIGH ENDURANCE AIRFOIL WITH GIVEN THICKNESS DISTRIBUTION AND REYNOLDS NUMBER Final Report
George S. Pick and Douglas A. Lien Jun. 1975 58 p refs (WF32421212)
(AD-A014126; ASED-1208; NSRDC-4670) Avail: NTIS CSCL 01/3

A design procedure has been developed that permits a high-endurance airfoil shape to be determined for a given initial thickness distribution and chord length Reynolds number. The Strand method, which is based on the Stratford theory of incipient separation and the optimization principle of the calculus of variations, was utilized to yield an optimized velocity distribution. Upper surface lift was maximized by the resultant distribution; however, the total lift was not maximized because of restrictions on the thickness distribution. A generalized parametric study of the upper surface velocity, lift, and drag characteristics for various flow conditions resulted in a series of preliminary design curves. These were used to select appropriate design lift coefficients and L/D ratios for further study. After the basic performance characteristics had been selected, a linear theory was used to determine the camber distribution of the airfoil. The velocity distribution that corresponded to the initial thickness and camber distribution obtained from the linear theory was then utilized as the initial input to a fully nonlinear theory (the James airfoil design method) to determine the final airfoil shape. Several iterations of the input were designed to determine the final airfoil shape. Several iterations of the input were necessary to obtain an output velocity distribution that was close to the desired one. The Von Doenhoff separation criterion was applied to the lower surface to determine whether separation would occur at the design condition. Computations showed that the flow was fully attached. GRA

N76-15154# Grumman Aerospace Corp., Bethpage, N.Y.
MANUFACTURING OF TITANIUM AIRFRAME COMPONENTS BY HOT ISOSTATIC PRESSING Final Report, Apr. 1974 - Apr. 1975
Robert H. Witt and Joel Magnuson Apr. 1975 98 p refs (Contract N00019-74-C-0301; AF Proj. D828)
(AD-A014130) Avail: NTIS CSCL 01/3

This program has demonstrated the feasibility of producing titanium airframe components by hot isostatic pressing (HIP) of titanium alloy powder. Task 1 culminated in the manufacture of an F-14A fuselage brace to near net shape with critical dimensions within the print tolerance. In addition, Task 2 demonstrated that aerospace design requirements could be met by Ti-6Al-6V-2Sn and Ti-6Al-4V as produced by HIP. Tensile, fatigue and toughness data are presented, which show that annealed plate properties can be attained or exceeded. Excellent fracture toughness (K1c) was obtained for Ti-6-6-2. Recommendations are presented for the manufacture of a pilot lot as the continuation of the present effort. Author (GRA)

N76-15155# McDonnell Aircraft Co., St. Louis, Mo.
HIGH ACCELERATION COCKPIT CONTROLLER LOCATIONS. VOLUME 1: PROGRAM SUMMARY Final Technical Report, Jun. - Dec. 1974
R. E. Mattes and C. F. Asiala May 1975 165 p refs 3 Vol. (Contract F33615-74-C-3093; AF Proj. 6190)
(AD-A014810; MDC-A2960-Vol-1; AFFDL-TR-75-58-Vol-1) Avail: NTIS CSCL 01/3

A controller-throttle design integration program was conducted for an advanced fighter concept with direct lift, direct side force, and high acceleration maneuvering capabilities. Several controller-throttle configuration design alternatives were evaluated in a high acceleration cockpit mock-up by USAF pilots in a static simulation evaluation phase. Cockpit and controller functional capabilities were tailored to satisfy operational needs for normal flight and combat phases and were evaluated within the context of a fighter mission. Objective and subjective data including reach and vision envelopes, task performance times, and pilot preferences from paired comparison and interview questionnaires were utilized to rank the configurations evaluated. Several principal areas for future high acceleration cockpit development were defined. Author (GRA)

N76-15156# McDonnell Aircraft Co., St. Louis, Mo.
HIGH ACCELERATION COCKPIT CONTROLLER LOCATIONS. VOLUME 2: TEST PLAN Final Technical Report, Jun. - Dec. 1974
C. F. Asiala and S. L. Loy May 1975 80 p refs 3 Vol. (Contract F33615-74-C-3093; AF Proj. 6190)
(AD-A014811; MDC-A2960-Vol-2; AFFDL-TR-75-58-Vol-2) Avail: NTIS CSCL 01/3

A high acceleration cockpit/controller design and integration program was conducted, using a full scale design aid. Alternate cockpit/controller configurations were developed for comparison using this full scale design aid in a formally structured evaluation including mission related task elements. Crew station and controller characteristics were thus related to operator needs in a mission context for advanced fighter concepts. Author (GRA)

N76-15157# McDonnell Aircraft Co., St. Louis, Mo.
HIGH ACCELERATION COCKPIT CONTROLLER LOCATIONS. VOLUME 3: ONSITE PILOT EVALUATIONS Final Technical Report, Jun. - Dec. 1974
R. E. Mattes and C. F. Asiala May 1975 45 p ref 3 Vol. (Contract F33615-74-C-3093; AF Proj. 6190)
(AD-A014812; MDC-A2960-Vol-3; AFFDL-TR-75-58-Vol-3) Avail: NTIS CSCL 01/3

A high acceleration cockpit evaluation program was conducted for an advanced fighter concept. Program effort included evaluations within the context of a mission scenario by a total of 40 operational pilots in a static design aid. Various specific areas of the concept were evaluated as well as the overall need/utility of the crew station. Result allowed identification of those areas where future research and development effort should be focused. GRA

N76-15019* Goodyear Aerospace Corp., Akron, Ohio.
EFFECT OF PRESENT TECHNOLOGY ON AIRSHIP CAPABILITIES
Robert T. Madden *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 31-40 (For availability see N76-15015 06-01)
CSCL 01B

N76-15022* Cranfield Inst. of Technology (England).
A STUDY OF DESIGN TRADE (OFFS) USING A COMPUTER MODEL
Stephen Coughlin *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 63-73 ref (For availability see N76-15015 06-01)
CSCL 01B

N76-15026* Massachusetts Inst. of Tech., Cambridge.
BASIC RELATIONSHIPS FOR LTA TECHNICAL ANALYSIS
Raymond A. Ausrotas *In its* Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 123-131 refs (For availability see N76-15015 06-01)
CSCL 01B

N76-15027* Naval Air Development Center, Warminster, Pa.
THE EFFECTS OF SELECTED MODERN TECHNOLOGICAL CONCEPTS ON THE PERFORMANCE AND HANDLING CHARACTERISTICS OF LTA VEHICLES
Carmen J. Mazza *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 133-146 refs (For availability see N76-15015 06-01)
CSCL 01B

N76-15028* Goodyear Aerospace Corp., Akron, Ohio.
BOUNDARY LAYER CONTROL FOR AIRSHIPS
F. A. Pake and S. J. Pipitone *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 147-155 refs (For availability see N76-15015 06-01)
CSCL 01A

N76-15029* Transportation Technology, Inc., Marblehead, Mass.
AIRSHIP STRESSES DUE TO VERTICAL VELOCITY GRADIENTS AND ATMOSPHERIC TURBULENCE
Duncan Sheldon *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 157-168 refs (For availability see N76-15015 06-01)
CSCL 01A

N76-15032* Ketron, Inc., Arlington, Va.
FLOATING VS FLYING: A PROPULSION ENERGY COMPARISON
Fendall Marbury *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 187-197 refs (For availability see N76-15015 06-01)
CSCL 01B

N76-15034* Utah Univ., Salt Lake City.
COMPUTER AIDED FLEXIBLE ENVELOPE DESIGNS
Ronald D. Resch *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 209-215 (For availability see N76-15015 06-01)
CSCL 01A

N76-15035* Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
LTA APPLICATION OF A LONG TRAILING WIRE HIGH SPEED/LOW WEIGHT REELING SYSTEM
D. F. Werb *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 217-222 (For availability see N76-15015 06-01)
CSCL 01A

N76-15036* National Aeronautics and Space Administration, Washington, D.C.
LTA STRUCTURES AND MATERIALS TECHNOLOGY
Norman J. Mayer *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 223-241 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15038* Southern California Aviation Council, Inc., Pasadena.
AIRSHIP CONSTRUCTION
John Roda *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 257-259 (For availability see N76-15015 06-01)
CSCL 01C

N76-15044* Slate All Metal Dirigible Co., Glendale, Calif.
THE SLATE ALL METAL AIRSHIP
Claude C. Slate and Richard D. Neumann (Southern Calif. Aviation Council, Inc.) *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 323-330 (For availability see N76-15015 06-01)
CSCL 01C

N76-15045* Turbomachines, Inc., Irvine, Calif.
STATE OF THE ART OF METALCLAD AIRSHIPS
V. H. Pavlecka and John Roda *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 331-349 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15046* Aerospace Developments, London (England).
THE AEROSPACE DEVELOPMENTS CONCEPT
John E. R. Wood *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 351-358 (For availability see N76-15015 06-01)
CSCL 01C

N76-15048* McMaster Univ., Hamilton (Ontario).
THE DESIGN AND CONSTRUCTION OF THE CAD-1 AIRSHIP
H. J. Kleiner, R. Schneider (Can. Airship Develop. Corp.), and J. L. Duncan *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 369-394 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15049* Goodyear Aerospace Corp., Akron, Ohio.
A LTA FLIGHT RESEARCH VEHICLE
Fred R. Nebiker *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 395-404 (For availability see N76-15015 06-01)
CSCL 01C

N76-15050* Airfloat Transport Ltd., Guildford (England).
THE AIRFLOAT HL PROJECT
Edwin Mowforth (Surrey Univ.) *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 405-414 (For availability see N76-15015 06-01)
CSCL 01C

N76-15051* United Technical Industries, El Segundo, Calif.
THE BASIC CHARACTERISTICS OF HYBRID AIRCRAFT
J. B. Nichols *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 415-430 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15052* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SEMIBUOYANT VEHICLE FOR GENERAL TRANSPORTATION MISSIONS
C. Dewey Havill and Michael Harper *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 431-439 (For availability see N76-15015 06-01)
CSCL 01C

N76-15053* Aereon Corp., Princeton, N.J.
THE DYNAIRSHIP
William McElwee Miller, Jr. *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 441-455 (For availability see N76-15015 06-01)
CSCL 01C

N76-15054* Flugwissenschaftliche Fachgruppe Goettingen e.V. (West Germany).
SOME ASPECTS OF HYBRID-ZEPPELINS
Paul-Armin Mackrodt *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 457-464 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15055* Piasecki Aircraft Corp., Philadelphia, Pa.
ULTRA-HEAVY VERTICAL LIFT SYSTEM: THE HELI-STAT
Frank N. Piasecki *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 465-476 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15056* Dynapods, Inc., New Orleans, La.
THE VARIABLE DENSITY AIRCRAFT CONCEPT
A. C. Davenport *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 477-483 (For availability see N76-15015 06-01)
CSCL 01C

N76-15063* Naval Air Systems Command, Washington, D.C.
AEROCRANE: A HYBRID LTA AIRCRAFT FOR AERIAL CRANE APPLICATIONS

Russel G. Perkins, Jr. and Donald B. Doolittle (All Am. Eng. Co.) *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 571-584 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15064* Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
UNMANNED POWERED BALLOONS
Arthur O. Korn *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 585-594 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15065* Naval Ordnance Lab., White Oak, Md.
SPECIAL PROBLEMS AND CAPABILITIES OF HIGH ALTITUDE LIGHTER THAN AIR VEHICLES
P. R. Wessel and F. J. Petrone *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 595-603 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15066* La Grue Volante, Chaville (France).
A PRACTICAL CONCEPT FOR POWERED OR TETHERED WEIGHT-LIFTING LTA VEHICLES
M. Alain Balleyguier *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 605-612 (For availability see N76-15015 06-01)
CSCL 01C

N76-15067* Sheldahl Co., Northfield, Minn. Tethered Aerostat Systems.
A REVOLUTIONARY AND OPERATIONAL TETHERED AEROSTAT SYSTEM ILLUSTRATING NEW LTA TECHNOLOGY
James A. Menke *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 613-622 (For availability see N76-15015 06-01)
CSCL 01C

N76-15068* Sheldahl Co., Northfield, Minn. Structures and Materials Engineering.
TECHNOLOGY UPDATE: TETHERED AEROSTAT STRUCTURAL DESIGN AND MATERIAL DEVELOPMENTS
Robert G. Witherow *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 623-635 (For availability see N76-15015 06-01)
CSCL 01C

N76-15069* Raven Industries, Inc., Sioux Falls, S.Dak.
TWO LIGHTER THAN AIR SYSTEMS IN OPPOSING FLIGHT REGIMES: AN UNMANNED SHORT HAUL, HEAVY LOAD TRANSPORT BALLOON AND A MANNED, LIGHT PAYLOAD AIRSHIP
R. A. Pohl *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 637-650 (For availability see N76-15015 06-01)
CSCL 01C

N76-15070* Mosher Balloon Systems, Inc., Eugene, Ore.
BALLOON LOGGING WITH THE INVERTED SKYLINE
C. Frank Mosher *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 651-666 (For availability see N76-15015 06-01)
CSCL 01C

N76-15071* Military Sealift Command, Washington, D.C. Program Development Div.
LOTS OF LTA APPLICATIONS
Jay S. Brown *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 667-677 refs (For availability see N76-15015 06-01)
CSCL 01C

N76-15072* Developmental Sciences, Inc., City of Industry, Calif.
REMOTELY PILOTED LTA VEHICLE FOR SURVEILLANCE
Gerald R. Seemann, Gordon L. Harris, and Glen J. Brown *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 679-683 (For availability see N76-15015 06-01)
CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-15158*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION OF A LANDING SITE INDICATOR (LASI) FOR LIGHT AIRCRAFT OPERATION
Harry V. Fuller and Bruce K. E. Outlaw Jan. 1976 23 p refs (NASA-TM-X-72811) Avail: NTIS HC $3.50 CSCL 01D

An experimental cockpit mounted head-up type display system was developed and evaluated by LaRC pilots during the landing phase of light aircraft operations. The Landing Site Indicator (LASI) system display consists of angle of attack, angle of sideslip, and indicated airspeed images superimposed on the pilot's view through the windshield. The information is made visible to the pilot by means of a partially reflective viewing screen which is suspended directly in frot of the pilot's eyes. Synchro transmitters are operated by vanes, located at the left wing tip, which sense angle of attack and sideslip angle. Information is presented near the center of the display in the form of a moving index on a fixed grid. The airspeed is sensed by a pitot-static pressure transducer and is presented in numerical form at the top center of the display. Author

N76-15159# Southampton Univ. (England).
A NEW PROBE FOR THE DIRECT MEASUREMENT OF STAGNATION PRESSURE IN SUPERSONIC FLOW
M. J. Goodyer London Aeron. Res. Council 1975 31 p refs Supersedes RAE-TR-73122; ARC-35388
(ARC-R/M-3762; RAE-TR-73122; ARC-35388) Avail: NTIS HC $4.00; HMSO £1.66; PHI $6.75

A new probe comprising two parts, a compression surface and a pitot tube, was developed which can measure the full stagnation pressure in supersonic flow. The probe decelerates a portion of the supersonic free stream into the subsonic range within a distributed compression fan. Stagnation pressure is sampled in the region of subsonic flow using a pitot tube. Pressure recovery has been measured over the Mach number range 1.5 to 2.5, a typical value being 0.999 at a Mach number of 1.88. The probe is usefully insensitive to misalignment with the free stream, and pressure tappings in the compression surface allow it to be used also as a flow direction sensor. Author (ESA)

N76-15160# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
SIMULATION OF AIRCRAFT DISPLAYS Final Technical Report, Feb. - Dec. 1974
David A. Ratino and Adolf R. Marko Jul. 1975 27 p
(AF Proj. 7222)
(AD-A014262; AMRL-TR-75-7) Avail: NTIS CSCL 01/4

The process of analyzing and solving various operational problems is often accomplished by means of some form of simulation. The report details some practical and inexpensive methods of displaying tracking task information that can be used in flight simulation. One topic is a simplified Instrument Landing System (ILS) cathode ray tube (CRT) display. A means of temperature stabilizing such a display is included. A sine/cosine trigonometric function generator useful in graphics display was designed. A very successful method of driving synchro-type aircraft instruments by other than conventional electromechanical or commercial solid state devices is described. Diagrams are given for all of the circuitry discussed. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-15161 Toledo Univ., Ohio.
AN APPLICATION OF MODERN CONTROL THEORY TO JET PROPULSION SYSTEMS Ph.D. Thesis
Walter Clyde Merrill 1975 153 p
Avail: Univ. Microfilms Order No. 75-29937

The control of an airbreathing turbojet engine by an onboard digital computer is studied. The turbojet engine is modeled as a linear, multivariable system whose parameters vary with engine operating environment. From this model adaptive closed-loop or feedback control laws are designed and applied to the acceleration of the turbojet engine. Dissert. Abstr.

N76-15162*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF TECHNOLOGICAL ADVANCEMENTS FOR REDUCING AIRCRAFT GAS TURBINE ENGINE POLLUTANT EMISSIONS
Richard A. Rudey Dec. 1975 50 p refs Submitted for publication
(NASA-TM-X-71846; E-8576) Avail: NTIS HC $4.00 CSCL 21E

Combustor test rig results indicate that substantial reductions from current emission levels of carbon monoxide (CO), total unburned hydrocarbons (THC), oxides of nitrogen (NOx), and smoke are achievable by employing varying degrees of technological advancements in combustion systems. Minor to moderate modifications to existing conventional combustors produced significant reductions in CO and THC emissions at engine low power (idle/taxi) operating conditions but did not effectively reduce NOx at engine full power (takeoff) operating conditions. Staged combusiton techniques were needed to simultaneously reduce the levels of all the emissions over the entire engine operating range (from idle to takeoff). Emission levels that approached or were below the requirements of the 1979 EPA standards were achieved with the staged combustion systems and in some cases with the minor to moderate modifications to existing conventional combustion systems. Results from research programs indicate that an entire new generation of combustor technology with extremely low emission levels may be possible in the future. Author

N76-15163# Committee on Aeronautical and Space Sciences (U. S. Senate).
AIRCRAFT FUEL EFFICIÉNCY PROGRAM
Washington GPO 1975 340 p refs Hearings before Comm. on Aeron. and Space Sci., 94th Congr., 1st Sess., 10 Sep., 23 Oct., and 4 Nov. 1975
(GPO-60-208) Avail: SOD HC $3.40

Research project planning and cost estimates are discussed for proposed NASA programs for aircraft fuel conservation. Aircraft design using composite materials for lightweight airframe construction is discussed. Also discussed are the development and testing of jet (turbofan) engines that will conserve fuel. Photographs are shown. J.R.T.

N76-15164# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Dept. Aerodynamique Experimentale.
INTERACTION OF GE CF6-50 JET REACTORS WITH THE AIRBUS BODY DURING CRUISING FLIGHT: WIND TUNNEL SIMULATION [INTERACTION DES JETS DES REACTEURS GE CF6-50 SUR LA CELLULE DE L'AIRBUS EN CROISIERE - SIMULATION EN SOUFFLERIE]
M. Saiz Paris Assoc. Aeron. et Astronautique de France 1975 41 p refs In FRENCH
(AAAF-NT-75-15; ISBN-2-7170-0333-9) Avail: NTIS HC$4.00; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

The interaction of double flux aircraft reactors of over 50,000 pounds thrust, as used in large passenger aircraft such as the European A.300.B Airbus, with the aircraft body, was studied. The balance of the drag and thrust components of the body-propulsive unit combination is discussed, and the experimental techniques for determining such interactions are described. Model simulation tests with a motorized nacelle in a supersonic wind tunnel are detailed. Finally, the use of pressure measurements made to check the validity of the experimental method and to derive the value of the reactor jet interaction during cruising flight is discussed. ESA

N76-15165# Dayton Univ. Research Inst., Ohio.
A REVISED COMPUTER PROGRAM FOR AXIAL COMPRESSOR DESIGN. VOLUME 2: PROGRAM LISTING AND PROGRAM USE EXAMPLE Final Report, 1 Oct. 1973 - 30 Nov. 1974
Richard M. Hearsey Jan. 1975 251 p refs
(Contract F33615-74-C-4030; AF Proj. 7065)
(AD-A009157; UDRI-TR-74-47-Vol-2; ARL-75-0001-Vol-2) Avail: NTIS CSCL 21/5

A revised computer program for the design of axial compressors is presented. It comprises three principal sections, two alternative means of determining blade geometry and an aerodynamic computation for the flow through the compressor. One method of determining blade geometry uses various analytic meanlines for the blade sections, and leads to the aerodynamic analysis of the flow through specified blading. The other method consists of creating arbitrary blade sections to follow the flow directions previously determined in an aerodynamic design calculation. The aerodynamic design section incorporates a loss calculation routine that may be used to estimate the design point performance of the compressor. One, two, or all three sections may be used in any one run of the program. This second volume of two describing the program shows the FORTRAN program listing and an example of the use of the program. GRA

N76-15166# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
TURBINE ENGINE CONTROL SYNTHESIS. VOLUME 1: OPTIMAL CONTROLLER SYNTHESIS AND DEMONSTRATION Final Technical Report, 30 Jun. 1972 - 15 Mar. 1975
C. R. Stone, N. E. Miller, M. D. Ward, and R. D. Schmidt Mar. 1975 340 p refs 3 Vol.
(Contract F33615-72-C-2190; AF Proj. 3066)
(AD-A014229; F0164-FR-Vol-1; AFAPL-TR-75-14-Vol-1) Avail: NTIS CSCL 21/5

The objective was to determine whether optimal control synthesis methods provide superior means for designing jet engine controllers. The methods design controllers with more capability and/or can be exploited to provide less expensive hardware. For newer kinds of engines the cost to design should be less than for presently used methods. Volume I summarizes optimal control design methodology. A paper design of a command and disturbance controller shows that good power lever command response can be achieved; the same controller is designed to be insensitive to inlet duct buzz. A command controller is synthesized and wind tunnel tested. This controller is a good approximation to time optimal with surge-stall, TT4, and flameout constraints. Small-amplitude control responses are precise. There is strong stability. GRA

N76-15167# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
TURBINE ENGINE CONTROL SYNTHESIS. VOLUME 2: SIMULATION AND CONTROLLER SOFTWARE Final Technical Report, 30 Jun. 1972 - 15 Mar. 1975
C. R. Stone, N. E. Miller, and M. D. Ward Mar. 1975 292 p refs 3 Vol.
(Contract F33615-72-C-2190; AF Proj. 3066)
(AD-A014230; F0164-FR-Vol-2; AFAPL-TR-75-14-Vol-2) Avail: NTIS CSCL 21/5

The objective was to determine whether optimal control synthesis methods provide superior means for designing jet engine controllers. The methods design controllers with more capability and/or can be exploited to provide less expensive hardware. For newer kinds of engines the cost to design should be less than for presently used methods. Volume 2 contains three

Appendices. Appendix A contains the details of engine math models. The software for the wind tunnel controller is presented in Appendix B. Appendix C contains a derivation of rate model following. GRA

N76-15168# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
TURBINE ENGINE CONTROL SYNTHESIS. VOLUME 3: EXPERIMENTAL ENGINE IDENTIFICATION AND MODELING Final Technical Report, 30 Jun. 1972 - 15 Mar. 1975
R. B. Beale and N. E. Miller Mar. 1975 163 p refs 3 Vol.
(Contract F33615-72-C-2190; AF Proj. 3066)
(AD-A014231; F0164-FR-Vol-3; AFAPL-TR-75-14-Vol-3) Avail: NTIS CSCL 21/5

This program develops a practical design procedure for turbine engine control systems based on multivariable control theory. This volume describes a practical procedure for experimentally obtaining high-fidelity linear engine models from frequency response measurements. This procedure satisfies the modeling requirements for high-bandwidth control systems which are needed in the future for better regulation of surge margins and disturbances. A dynamic transfer matrix model of the GE-J85-13 engine is obtained at three engine operating speeds. The instrumentation is described for obtaining tape-recorded engine responses. Fourier filtering and servoanalysis techniques are demonstrated. An algorithm is described for identifying dynamic states and transfer functions from frequency responses. GRA

N76-15169# ARO, Inc., Arnold Air Force Station, Tenn.
TURBINE ENGINE EXHAUST NOZZLE PERFORMANCE WITH NONUNIFORM INLET FLOW Final Report, Jul. 1973 - Jun. 1974
S. Wehofer and R. J. Matz AEDC Aug. 1975 60 p refs
(ARO Proj. RF442)
(AD-A014261; ARO-ETF-TR-75-43; AEDC-TR-75-82) Avail: NTIS CSCL 21/5

The internal fluid dynamic performance of various turbine engine exhaust nozzle configurations was experimentally investigated. Nine fixed-geometry exhaust nozzle models representative of contemporary turbofans operating at various power levels were evaluated with uniform inlet conditions and with radial nonuniformities in total pressure and total temperature. The test conditions are representative of both low bypass turbofan and turbojet tailpipe flows. The effects of nozzle throat lip geometry on nozzle performance were evaluated. Also, the results obtained from the experimental phase were compared with the performance predicted from a numerical analysis developed at the Arnold Engineering Development Center. The major conclusion is that nozzle performance coefficients cannot be ascribed to a given nozzle configuration without some specification of the nozzle inlet flow conditions and coefficient referencing procedures. Author (GRA)

N76-15170# Technology, Inc., Dayton, Ohio.
INTEGRATED AEROSPACE ENGINE MANAGEMENT. FOUNDATIONS IN ESTIMATION AND PREDICTION OF ENGINE REMOVALS Final Report, 15 May - 22 Aug. 1974
Laurence L. George ARL Jun. 1975 74 p refs
(Contract F33615-73-C-4155; AF Proj. 7071)
(AD-A014368; ARL-75-0137) Avail: NTIS CSCL 21/5

Aerospace engine management is an exceedingly complicated problem with important consequences. Analytical management techniques may have potential application in a future, integrated engine management system. Fundamental to any such system is information about engine lives and the number of engine replacements required to meet flying hour program requirements. In this report, the engine management problem is described in the context of a production system producing flying hours. This perspective shows the necessity for engine life information since the engines produce flying hours. The maximum likelihood estimator of a multi-risk engine life cumulative distribution function with inspections has been derived. It may be an improvement over the actuarial method now used, and information about usage removals and inspection removals is also available from the maximum likelihood estimator. An hierarchical sequence of families of distributions has been constructed for ease of sequential likelihood ratio testing for more information about the engine life distributions. GRA

N76-15171# Detroit Diesel Allison, Indianapolis, Ind. Detroit Diesel Allison Div.
EXPERIMENTAL INVESTIGATION OF A SUPERSONIC COMPRESSOR CASCADE Final Report, Jul. 1971 - Apr. 1973
Sanford Fleeter, Robert L. Holtman, Robert B. McClure, and George T. Sinnet Jun. 1975 331 p refs
(Contract F33615-71-C-1766; AF Proj. 7065)
(AD-A014395; ARL-75-0208) Avail: NTIS CSCL 21/5

This report describes in detail the experimental investigation of a stationary, linear, supersonic compressor cascade with blades of constant spanwise geometry and constant thickness linear sidewalls. The selected blade element was representative of streamline 19 of an advanced compressor configuration resulting from the Aerospace Research Laboratories axial compressor research program. The investigation covered the range of inlet relative Mach numbers of 1.535 1.683 and a range of static pressure ratios of approximately 1.1 - 2.3 and included laser velocimeter measurements of the flow within and around the cascade at the design Mach number. GRA

N76-15172# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
SUBSONIC LIQUID FUELED LOW COST RAMJET Final Report, 1 May 1973 - 30 Jun. 1974
Charles M. Donaldson and Charles E. Hornbeck Jun. 1975 80 p refs
(AF Proj. 3012)
(AD-A014339; AFAPL-TR-74-116) Avail: NTIS CSCL 21/5

The purpose of this program was to extend the operating flight envelope of a subsonic liquid fueled ramjet engine from altitude of 20,000 feet to 30,000 feet. The subsonic ramjet engine is a very low cost propulsion system applicable to many tactical applications such as standoff weapons, drones, and targets. The investigation consisted of a direct-connect test program in the AFAPL Ramjet Test Facility. Tests were performed with the use of exhausters and airflow controls to simulate subsonic flight conditions representative of tactical missiles. The combustor investigated was a combination of a cone and V-gutter. Engine performance obtained is presented in the form of combustion efficiency and thrust. Author (GRA)

N76-15173# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY OF AN INTERNAL AIR-COOLED GAS TURBINE BLADE
V. G. Tyryshkin, M. I. Gruntfest, and V. A. Mikhailova 26 Jun. 1975 19 p refs Transl. into ENGLISH from Energomashinostroenie (USSR), no. 3, 1967 p 13-16
(AD-A014523; FTD-ID(RS)I-1479-75) Avail: NTIS CSCL 21/5

Aviation gas turbines are making more use of blades internally cooled by air taken from the cycle. Such blades reduce temperatures ahead of the turbine, increasing specific power and decreasing fuel flow, but involve energy losses and decrease of efficiency. A study is reported of one construction of a moving blade cooled by forced convection, in which the cooling air escapes from the blade into the interior of the turbine. GRA

N76-15174# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPARISON OF TURBOJET, TURBOROCKET, AND RAMJET AS A PROPULSION SYSTEM FOR LONG RANGE AIRPLANES AT MACH NUMBERS BETWEEN 2 AND 4
E. Riester 31 Jul. 1975 38 p refs Transl. into ENGLISH from Deut. Luft- und Raumfahrt. Forschungsbericht (West Ger.), no. 38, 1972 p 1-36
(AD-A014312; FTD-ID(RS)I-1653-75) Avail: NTIS CSCL 21/5

In the Mach number range between 2 and 4, a transition to another propulsion system is expected for long range airplanes. Limited to the cruise range, the turbojet, the turborocket and the ramjet are investigated. Considering also the additional drag, engines are compared, whose air flow rates have the same cross section area for the undisturbed flow in front of the engine. It is shown that even with modern component technology, the turbojet is the optimum propulsion system only up to the Mach number 3.5. Above this Mach number, the ramjet becomes more

effective. The turborocket is interesting at high Mach numbers because of its high thrust density, although its specific impulse is somewhat less. GRA

N76-15175# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
GRAVIMETRIC DETERMINATION OF SEDIMENT IN TURBINE ENGINE LUBRICATING OILS Technical Report, Mar. - Oct. 1974
W. R. Craig Jul. 1975 21 p refs
(AF Proj. 3048)
(AD-A014340; AFAPL-TR-75-32) Avail: NTIS CSCL 11/8

This program was conducted to establish the usefulness of gravimetric filtration for the quantitative determination of the total combustible and noncombustible sediment present in aircraft turbine engine lubricating oils. Both MIL-L-7808 and MIL-L-23699 lubricants were investigated. These lubricants were filtered through various pore size cellulose and silver membrane filters. The amount of sediment was determined by weight difference. Noncombustible sediment was determined by igniting the test filter in a muffle furnace and weighing the amount of sediment remaining after ignition. Overall results of this work show that current synthetic lubricating fluids contain less than 10 mgm/1 of total sediment. Total sediment values of both MIL-L-23699 and MIL-L-7808 oils were found to be uniformly low in most instances. However, some MIL-L-7808 formulations were nonfilterable at room temperature. When these oils were heated to 140 F, they easily passed through a silver membrane filter. A test procedure for the gravimetric measurement of particulate contamination in turbine engine lubricating oils is proposed.
Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-15176*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
SUBSONIC STABILITY AND CONTROL DERIVATIVES FOR AN UNPOWERED, REMOTELY PILOTED 3/8-SCALE F-15 AIRPLANE MODEL OBTAINED FROM FLIGHT TEST
Kenneth W. Iliff, Richard E. Maine, and Mary F. Shafer Washington Jan. 1976 32 p refs
(NASA-TN-D-8136; H-905) Avail: NTIS HC $4.00 CSCL 01C

In response to the interest in airplane configuration characteristics at high angles of attack, an unpowered remotely piloted 3/8-scale F-15 airplane model was flight tested. The subsonic stability and control characteristics of this airplane model over an angle of attack range of -20 to 53 deg are documented. The remotely piloted technique for obtaining flight test data was found to provide adequate stability and control derivatives. The remotely piloted technique provided an opportunity to test the aircraft mathematical model in an angle of attack regime not previously examined in flight test. The variation of most of the derivative estimates with angle of attack was found to be consistent, particularly when the data were supplemented by uncertainty levels. Author

N76-15177# Dynamic Controls, Inc., Dayton, Ohio.
RESEARCH AND DEVELOPMENT OF AIRCRAFT CONTROL ACTUATION SYSTEMS. THE DEVELOPMENT OF A FLIGHT CONTROL SYSTEM SIMULATOR, RESEARCH ON A CONTROL SURFACE FLUTTER SUPPRESSION TECHNIQUE AND HIGH TEMPERATURE TESTING OF MIL-H-83282 Final Report, Jan. 1974 - Feb. 1975
Gavin D. Jenny Jan. 1975 203 p refs
(Contract F33615-74-C-3020; AF Proj. 1987)
(AD-A014367; AFFDL-TR-75-29) Avail: NTIS CSCL 01/3

This report presents the results of the following three research and development activities: the design, fabrication and test of a multi-channel flight control system hybrid simulator; the analysis and application of a flutter damping technique for hydraulically actuated slab type control surfaces; and the experimental testing of Mil-H-83282 hydraulic fluid in a pumping system at elevated temperature. GRA

N76-15178# AiResearch Mfg. Co., Phoenix, Ariz.
PROGRAM TO DEVELOP A FLUIDIC APPROACH POWER COMPENSATOR FOR NAVAIRDEVCEN Final Report, Dec. 1973 - Apr. 1975
Thomas B. Tippets and William F. Ryan 19 Jun. 1975 51 p refs
(Contract N62269-74-C-0262)
(AD-A014571; Rept-75-411029) Avail: NTIS CSCL 01/3

An approach power compensator is a device that controls aircraft landing approach airspeed by modulating engine power. Angle of attack, normal acceleration, and elevator position are sensed, and the resulting signals are processed to position an actuator connected to the engine throttle. The device described incorporates a pneumatic piston actuator driven by a fluidic circuit that performs computation, dynamic compensation, and safety override functions. Sensing is done electrically, with the resulting electrical signals converted by electrofluidic transducers. The actuator is powered by a pulse-duration-modulated, supersonic digital fluidic amplifier. Circuits are temperature compensated for stable operation. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-15179*# Contraves Goerz Corp., Pittsburgh, Pa.
THE 3-AXIS DYNAMIC MOTION SIMULATOR (DMS) SYSTEM Final Report
22 Nov. 1975 175 p
(Contract NAS9-14185)
(NASA-CR-147394; R-3599) Avail: NTIS HC $6.75 CSCL 14B

A three-axis dynamic motion simulator (DMS) consisting of a test table with three degrees of freedom and an electronics control system was designed, constructed, delivered, and tested. Documentation, as required in the Data Requirements List (DRL), was also provided. Author

N76-15180# National Aviation Facilities Experimental Center, Atlantic City, N.J.
STUDIES OF SUBMINIATURE LAMPS USED FOR INDICATING PURPOSES IN THE SYSTEM MAINTENANCE MONITOR CONSOLE Final Report, Jul. 1974 - Feb. 1975
Art Moss, Lane Hinkley, and Helen W. Hamilton Oct. 1975 30 p refs
(AD-A017064/7; FAA-NA-75-19; FAA-RD-75-168) Avail: NTIS HC $4.00 CSCL 13/1

Several types of subminiature lamps were investigated to determine their suitability as replacements for the incumbent type 247. Tests were performed to determine their relative mean lifetimes, as well as their general acceptability from a standpoint of brightness. From an overall viewpoint, considering cost, availability, mean life, and acceptable brightness, the type 685 subminiature lamp was found to be the most suitable replacement for the type 247, provided, during the transition replacement period, they are not mixed with the brighter type 247's in the color positions of the PRI's. Author

N76-15181# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
NONDESTRUCTIVE VIBRATORY TESTING OF AIRPORT PAVEMENTS. VOLUME 1: EXPERIMENTAL TEST RESULTS AND DEVELOPMENT OF EVALUATION METHODOLOGY AND PROCEDURE Final Report, Oct. 1972 - Nov. 1973
James L. Green and Jim W. Hall Sep. 1975 202 p refs
(Contract DOT-FA71WAI-218)

(AD-A017511/7; FAA-RD-73-205-Vol-1) Avail: NTIS HC $7.75 CSCL 01/5

Conventional direct sampling methods of airport pavement evaluation interfere with aircraft operations; therefore, an evaluation procedure based on nondestructive vibratory testing was developed. The procedure considers the parameters of pavement thickness and strength, soil strength, landing gear characteristics, and load repetition through correlation of FAA direct sampling procedures with the nondestructive data form termed the dynamic stiffness modulus, which is calculated from a vibratory load-deflection graph. The results indicated the need for standardized vibratory testing equipment, and specifications for a suggested model were written. Evaluation procedures were developed for rigid and flexible pavements which consider the environmental factors of temperature and frost-thaw action, the importance of test locations and quantities, and stabilized layers. Results are presented of two correlations: (a) elastic deflection and pavement performance and (b) dynamic E-modulus and CBR. The nondestructive testing and performance results on U. S. Army Engineer Waterways Experiment Station test sections are given along with the effects of bound pavement thickness on the nondestructive test results in an attempt to develop overlay design. Procurement specifications for recommended nondestructive test equipment are included. Author

N76-15182# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavement Lab.

STATISTICAL QUALITY CONTROL PROCEDURES FOR AIRPORT PAVEMENT MATERIALS Final Report

E. Ray Brown Oct. 1975 85 p refs

(Contract DOT-FA71WAI-218)

(AD-A017594/3; FAA-RD-73-199) Avail: NTIS HC$5.00 CSCL 13/3

Present pavement quality control procedures are inadequate because conventional control test results cannot predict the degree of compliance with specifications requirements of materials being evaluated. More accuracy in prediction is possible when statistical quality control procedures are applied. Conventional methods of control cause material that is accepted on one job to be rejected on another job due solely to the differences in opinion of the engineers in charge. Statistical quality control standardizes the specification requirements from one job to another by better describing the procedures for evaluating pavement materials and construction. Author

N76-15183# European Space Agency, Paris (France).

THE AVA DERIVATIVE BALANCE

E. Schmidt Oct. 1975 69 p refs Transl. into ENGLISH of "Die AVA-Derivativawaage", DFVLR, Goettingen, West Ger. Report DLR-Mitt-74-32, Jul. 1974 Original German report available from DFVLR, Porz, West Ger. 21 DM

(ESA-TT-197; DLR-Mitt-74-32) Avail: NTIS HC $4.50

The AVA derivative balance was designed to measure dynamic-stability derivatives on sting-mounted slender aircraft models in the DFVLR low-speed wind tunnels. Harmonic model motions of small amplitude in pitch and heave (2 deg of freedom) or in yaw, roll and sideslip (3 deg of freedom) are rigidly forced to evaluate the corresponding derivatives. The mechanical construction and measuring equipment of the balance system are described together with the data reduction method based on the Ritz-Galerkin energy equations of model motion. Some typical results of the longitudinal derivatives of an aspect-ratio-one delta wing, which were measured in the low-speed wind tunnel of AVA Goettingen, demonstrate the reliability of the new test set up. Author (ESA)

N76-15184# Illinois Univ., Urbana. Dept. of Civil Engineering.

ALTUS AFB DEEP SOIL LAYER STABILIZATION TEST SECTIONS. VOLUME 1: DESIGN AND EVALUATION Final Report, 21 Jan. 1970 - 28 Jan. 1975

M. R. Thompson and Q. L. Robnett Aug. 1975 125 p refs 2 Vol.

(Contract F29601-70-C-0024; AF Proj. 2104)

(AD-A014324; AFWL-TR-74-178-Vol-1) Avail: NTIS CSCL 01/5

Information and data on stabilization of deep soil layers indicated that certain stabilization procedures should be evaluated in various field test section studies. The report describes the design, construction and evaluation of drill hole lime, pressure injection lime, and post-hole pile test sections built at Altus Air Force Base, Oklahoma. All of the stabilization procedures effected a strengthening in at least one of the test sections. The general ranking of procedure effectiveness was: (1) Post-hole pile; (2) pressure injection lime, and (3) drill hole lime. GRA

N76-15185# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.

ALTUS AFB DEEP SOIL LAYER STABILIZATION TEST SECTIONS. VOLUME 2: INSTRUMENTATION, CONSTRUCTION AND DATA COLLECTION Final Report, 1 Mar. 1973 - 31 Dec. 1974

George E. Triandafilidis and Larry W. Bickle Aug. 1975 189 p refs 2 Vol.

(Contract F29601-74-C-0030; AF Proj. 2104)

(AD-A014325; AFWL-TR-74-178-Vol-2) Avail: NTIS CSCL 01/5

The basic objective of the research program was to select an airfield with a weak subgrade and to study the strengthening of the subgrade by using different stabilization procedures which included post-hole pile stabilization, drill-hole lime stabilization and lime stabilization by pressure injection. Eleven different full scale test sections were stabilized using the above stabilization techniques while one test section was untreated for a qualitative comparison of the effectiveness of the various stabilization techniques. The test sections were instrumented for measurement of stress and relative displacement. Comparative measurements were taken by loading the various test sections with a load cart which simulated the landing gear of a Boeing 747 aircraft. GRA

N76-15186# ARO, Inc., Arnold Air Force Station, Tenn.

STATIC FORCE AND MOMENT TESTS OF THE HOLLOMAN NARROW-GAGE ROCKET SLED AT MACH NUMBERS FROM 1.5 TO 4.0 Final Report, 26 Sep. - 3 Oct. 1974

R. H. Phudy and J. D. Corce AEDC Aug. 1975 58 p refs (ARO Proj. V41A-45A)

(AD-A014259; ARO-VKF-TR-75-6; AEDC-TR-75-29) Avail: NTIS CSCL 14/2

Experimental static stability and axial force data are presented for several one-twelfth scale model configurations of a Narrow-Gage Dual-Rail Rocket Sled at Mach numbers from 1.5 to 4.0. The test Reynolds numbers, based on sled base diameter, varied from 0.5 to 1.4 million depending on configuration and/or Mach number. The tests were conducted with the models in close proximity to a ground plane and rail assembly simulating the High Speed Test Track at Holloman Air Force Base. Results are presented showing the effects of configuration variables, such as, nose shape, water brake, water brake trough, bleed area, and sled slipper height and location. Author (GRA)

N76-15187# ARO, Inc., Arnold Air Force Station, Tenn.

FLOW GENERATION PROPERTIES OF FIVE TRANSONIC WIND TUNNEL TEST SECTION WALL CONFIGURATIONS Final Report, 1 Jul. - 9 Dec. 1974

R. L. Parker, Jr. AEDC Aug. 1975 48 p refs

(ARO Proj. P32A-29A)

(AD-A014260; ARO-PWT-TR-75-37; AEDC-TR-75-73) Avail: NTIS CSCL 14/2

Tests were conducted in the Aerodynamic Wind Tunnel (1T) of the Propulsion Wind Tunnel Facility to determine the tunnel calibration and centerline Mach number distribution for five transonic wall configurations. Data were also obtained with a cone-cylinder model to determine the effects of model blockage on the free-stream Mach number development in the test section. During the test, the Mach number was varied from 0.6 to 1.3. The wall porosity was varied to obtain data at representative values for each wall configuration. This report presents the test results and provides data to guide the operation of Tunnel 1T with the five transonic wall configurations. Author (GRA)

N76-15188# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.

CONTROL OF CORROSION IN GROUND SUPPORT EQUIPMENT Interim Report

W. H. Womer Jun. 1975 52 p refs

(AD-A014557; NAEC-GSED-91) Avail: NTIS CSCL 01/5

A two year (1972-1974) survey of corrosion in the mechanical elements of ground support equipment was conducted based on the corrosion maintenance manhours reported in the 3M Data Bank. Inventories of all major Navy Commands were reviewed. Data did not pinpoint any severe corroded equipment, areas or corrosion situations. However, the total headings under which all corrosion is reported was determined to be probably too broad for the definitive purposes of this program. A more refined review is necessary to establish any corrosion problem and eventually develop a corrosion control manual for ground support equipment. Author (GRA)

N76-15042* Walker (Hepburn, Jr.), Vero Beach, Fla.
MOORING AND GROUND HANDLING RIGID AIRSHIPS
Hepburn Walker, Jr. *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 297-310 refs (For availability see N76-15015 06-01)
CSCL 01E

N76-15043* Naval Air Systems Command, Washington, D.C.
A NEW CONCEPT FOR AIRSHIP MOORING AND GROUND HANDLING
John C. Vaughan *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 311-321 refs (For availability see N76-15015 06-01)
CSCL 01E

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-15189* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD FOR MANUFACTURING MIRRORS IN ZERO GRAVITY ENVIRONMENT Patent
David E. Pitts, inventor (to NASA) Issued 16 Dec. 1975 11 p Filed 27 Feb. 1974 Supersedes N74-33142 (12 - 22, p 2730)
(NASA-Case-MSC-12611-1; US-Patent-3,927,227; US-Patent-Appl-SN-446560; US-Patent-Class-427-162; US-Patent-Class-350-288; US-Patent-Class-350-293; US-Patent-Class-427-250) Avail: US Patent Office CSCL 20F

A system for forming large mirror surfaces in zero gravity space environments was described and illustrated. In particular, it relates to methods and apparatus for coating a curved surface in a zero gravity environment with a vaporizable metal to form a mirror. The technique consists in locating a shaped surface in a space orbit, orienting the central axis of the section toward the sun and vaporizing a finite amount of vaporizable metal (in amount calculated to provide a thin layer of metal) onto the surface of the section. A shaped surface can be formed by inflating a plastic to a spherical shape and hardening it. Y.J.A.

N76-15190*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Sep. - Oct. 1975
15 Dec. 1975 312 p refs
(Contract NAS7-100)
(NASA-CR-145987; JPL-PR-42-30) Avail: NTIS HC $9.75
CSCL 22D

Work accomplished on the Deep Space Network (DSN) was described, including the following topics: supporting research and technology, advanced development and engineering, system implementation, and DSN operations pertaining to mission-independent or multiple-mission development as well as to support of flight projects. For individual titles, see N76-15191 through N76-15212.

N76-15191* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **c14**
DSN FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Dec. 1975 p 1-4 (For availability see N76-15190 06-12)
CSCL 14B

The objectives, functions, and organization of the Deep Space Network were summarized. Deep space station, ground communication, and network operations control capabilities are described. Author

N76-15192* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **c14**
DSN TEST AND TRAINING SYSTEM
H. C. Thorman *In its* The Deep Space Network 15 Dec. 1975 p 5-15 refs (For availability see N76-15190 06-12)
CSCL 14B

Key characteristics of the Deep Space Network Test and Training System were presented. Completion of the Mark III-75 system implementation is reported. Plans are summarized for upgrading the system to a Mark III-77 configuration to support Deep Space Network preparations for the Mariner Jupiter/Saturn 1977 and Pioneer Venus 1978 missions. A general description of the Deep Space Station, Ground Communications Facility, and Network Operations Control Center functions that comprise the Deep Space Network Test and Training System is also presented. Author

N76-15193* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **c17**
SUMMARY REPORT ON THE VIKING 1975 DSN TELECOMMUNICATIONS COMPATIBILITY TEST PROGRAM
A. I. Bryan *In its* The Deep Space Network 15 Dec. 1975 p 16-56 ref (For availability see N76-15190 06-12)
CSCL 17B

The system design tests and test results that provided the basis for establishment of telecommunications design between the DSN and Viking 1975 were described. The Viking 1975/DSN Telecommunications Compatibility Test Program Consisted of three phases: subsystem design, system design, and system verification tests which were performed at JPL and at the Air Force Eastern Test Range and Kennedy Space Center complexes. Subsystem design tests were performed with the Viking Orbiter (VO) and the Viking Lander (VL) during 1973. System design compatibility tests were performed with the Viking Proof Test Orbiter, Viking Spacecraft Test Lander, and a multiple Viking spacecraft configuration during the summer of 1974. System verification tests were performed with the Viking Orbiter, Viking Lander and Viking spacecraft during the spring and summer of 1975. Author

N76-15194* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **c14**
VIKING MISSION SUPPORT
D. J. Mudgway and D. W. Johnston *In its* The Deep Space Network 15 Dec. 1975 p 57-60 ref (For availability see N76-15190 06-12)
CSCL 22D

The launches of Vikings 1 and 2 and the circumstances surrounding each launch were described, followed by early cruise coverage of both spacecraft. The planetary testing effort being carried out by the DSN to prepare for planetary operations was also described. Author

N76-15195* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **c14**
PIONEER MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Dec. 1975 p 61-64 ref (For availability see N76-15190 06-12)
CSCL 22D

The current status of the Pioneer 10 and 11 missions and Pioneer Venus 1978 mission was described. Author

N76-15196* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **c14**
HELIOS MISSION SUPPORT
P. S. Goodwin, W. G. Meeks, R. E. Morris, and S. E. Reed *In its* The Deep Space Network 15 Dec. 1975 p 65-69 ref (For availability see N76-15190 06-12)
CSCL 22D

Testing activities of the Helios-B spacecraft were reported. This spacecraft has completed its dual superior conjunctions and second perihelion passage of the sun and is rapidly approaching its second aphelion, near the earth's heliocentric trajectory. Valuable scientific data was obtained during these two important events. Author

N76-15197* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **c17**
A NEW GLOBAL IONOSPHERIC MODEL
K. W. Yip and O. H. VonRoos *In its* The Deep Space Network

15 Dec. 1975 p 70-87 refs (For availability see N76-15190 06-12)
CSCL 17B

A new global ionospheric model was successfully implemented. The daytime portion of this model provides one-way ionospheric range corrections that compare favorably with those derived from the Mariner Venus/Mercury S- and X-band dual frequency Doppler data. For elevation angles, gamma higher than 30 deg and solar zenith angle less than 80 deg, this model provides calibrations accurate to a few centimeters. The calibrations provided by the nighttime model are also very reasonable. It is interesting to note that the daytime ionospheric calibrations derived from the current calibration scheme, DIEN/TIEN, are fairly close to those given by the new global model, especially in the temporal variations and thus the Doppler effects. The comparison between the nighttime model and DIEN/TIEN was based on the one-way ionospheric range corrections for three passes near the Mariner 9 encounter with Mars in 1971. They can differ by over 30%. Author

N76-15198* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CORRUPTION OF RADIO METRIC DOPPLER DUE TO SOLAR PLASMA DYNAMICS: S/X DUAL-FREQUENCY DOPPLER CALIBRATION FOR THESE EFFECTS c32
F. B. Winn, S. R. Reinbold, K. W. Yip, R. E. Koch, and A. Lubeley *In its* The Deep Space Network 15 Dec. 1975 p 88-101 refs (For availability see N76-15190 06-12)
CSCL 20N

Doppler data from Mariner 6, 7, 9, and 10 and Pioneer 10 and 11 were discussed and the rms noise level for various sun-earth-probe angles were shown. The noise levels of both S- and X-band Doppler data for sun-earth-probe angles smaller than 20 deg were observed to be orders of magnitude greater than nominal. Such solar plasma-related Doppler degradation reduced the Mariner 10-Mercury 11 encounter navigation accuracy by nearly a factor of 10. Furthermore, this degradation was shown to be indirectly related to plasma dynamics and not a direct measure of the dynamics. Author

N76-15199* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A 100-kHz FREQUENCY DIVIDER, DISTRIBUTION AMPLIFIER c33
G. Lutes *In its* The Deep Space Network 15 Dec. 1975 p 102-104 (For availability see N76-15190 06-12)
CSCL 09C

A frequency divider, distribution amplifier module having low phase noise and low phase drift with temperature and high isolation between outputs was developed for use in the hydrogen maser frequency standard, where it divides 1 MHz from the previous frequency divider down to 100 kHz and provides four transistor-transistor logic (TTL) outputs. Author

N76-15200* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE X-BAND LOW NOISE ANTENNA MEASUREMENT CONE c32
M. S. Reid, F. E. McCrea, K. B. Wallace, and C. T. Stelzried *In its* The Deep Space Network 15 Dec. 1975 p 105-112 refs (For availability see N76-15190 06-12)
CSCL 17B

An X-band low-noise receiving cone with 17-MHz instantaneous bandwidth was built to evaluate the 26-m antenna at the Venus Station (DSS 13), Goldstone, California, at X-band frequencies, and also to provide a means for precise radio source calibrations in this frequency range. These measurments are necessary to provide more accurate antenna gain performance calibrations for the 64-m antenna subnet. The zenith system temperatures with the cone on the ground and on the antenna are 17.5 and 20.8 K, respectively. Author

N76-15201* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF DSS 13 26-m ANTENNA AT X-BAND c32
A. J. Freiley *In its* The Deep Space Network 15 Dec. 1975 p 113-118 refs (For availability see N76-15190 06-12)
CSCL 17B

The X-band low-noise antenna (XLA) measurement feedcone was operated on the DSS 13 26-m antenna at Goldstone, California, during June 1975 to evaluate, primarily, the overall system efficiency. Radio sources were selected, commonly accepted values of flux density established, and measurements completed, and some conclusions were drawn. The antenna system presently suffers from poor pointing stability. On the other hand, the previously welded and rebolted main reflector has remained quite stable over a period of approximately 5 years. Author

N76-15202* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS 14 X-BAND RADAR FEEDCONE c32
D. E. Neff and D. A. Bathker *In its* The Deep Space Network 15 Dec. 1975 p 119-131 refs (For availability see N76-15190 06-12)
CSCL 17B

A high-power 400-kW continuous-wave (CW) X-band radar feed system was described for use with the Goldstone, California, 64-m DSS 14 antenna system. Design considerations, their solutions, and final system testing are discussed. The radar system, unique in terms of antenna size, radiated power, and efficiency, became operational in December 1974. Author

N76-15203* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A VERSATILE DATA ACQUISITION SYSTEM FOR GOLDSTONE c14
M. S. Reid and R. A. Gardner *In its* The Deep Space Network 15 Dec. 1975 p 132-143 refs (For availability see N76-15190 06-12)
CSCL 14B

A data acquisition system set up at Goldstone was described. It is capable of recording a wide variety of parameters from widely separated geographical locations with varying integration times and recording speeds. It is fast, accurate, and modular in form so that it can be readily expanded. The accuracies of the system are discussed, and examples of data recorded with the system's capability of operation with preprocessing are given. Author

N76-15204* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROCONTROLLER FOR AUTOMATION APPLICATION c32
H. W. Cooper *In its* The Deep Space Network 15 Dec. 1975 p 144-147 (For availability see N76-15190 06-12)
CSCL 17B

The description of a microcontroller currently being developed for automation application was given. It is basically an 8-bit microcomputer with a 40K byte random access memory/read only memory, and can control a maximum of 12 devices through standard 15-line interface ports. Author

N76-15205* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXCITER SWITCH c33
W. L. McPeak *In its* The Deep Space Network 15 Dec. 1975 p 148-183 refs (For availability see N76-15190 06-12)
CSCL 09A

A new exciter switch assembly has been installed at the three DSN 64-m deep space stations. This assembly provides for switching Block III and Block IV exciters to either the high-power or 20-kW transmitters in either dual-carrier or single-carrier mode. In the dual-carrier mode, it provides for balancing the two drive signals from a single control panel located in the transmitter local control and remote control consoles. In addition to the improved switching capabilities, extensive monitoring of both the exciter switch assembly and Transmitter Subsystem is provided by the exciter switch monitor and display assemblies. Author

N76-15206* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM PERFORMANCE WITH CONVOLUTIONALLY CODE DATA c17
B. D. L. Mulhall, B. Benjauthrit, C. A. Greenhall, D. M. Kuma, J. K. Lam, J. S. Wong, J. Urech, and L. D. Vit *In its* The Deep Space Network 15 Dec. 1975 p184-213 refs (For availability see N76-15190 06-12)
CSCL 17B

The results obtained to date and the plans for future experiments for the DSN telemetry system were presented. The performance of the DSN tlemetry system in decoding convolutionally coded data by both sequential and maximum likelihood techniques is being determined by testing at various deep space

stations. The evaluation of performance models is also an objective of this activity. Author

N76-15207* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT **c14**
E. B. Jackson *In its* The Deep Space Network 15 Dec. 1975 p 214-221 ref (For availability see N76-15190 06-12)
CSCL 14B

The activities at the Venus Station (DSS 13) and the Microwave Test Facility, both operated by the Development Support Group, during the 6-month period ending October 15, 1975, were discussed and progress noted. Successful remote operation of the Venus Station from Pasadena during a pulsar observing track was desrcibed, along with significant tracking of the planet Venus in an interferometric planetary radar mode. Completion of the first phase of the demonstration of long-distance (1.6-km) transmission of microwave power was reported, with an RF-to-dc conversion efficiency of better than 80% and 30 kW of dc recovered. Routine transmission of clock synchronization signals to the overseas complexes with 64-m antenna stations was also discussed, and extensive analysis of a reported problem with the DSS 14 HV dc power supply which resulted in excessive ripple voltage interfering with transmitter operation was described. Author

N76-15208* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYMBOL SYNCHRONIZER ASSEMBLY INSTABILITY STUDY, PART 2 **c32**
R. C. Bunce *In its* The Deep Space Network 15 Dec. 1975 p 222-230 refs (For availability see N76-15190 06-12)
CSCL 17B

Data processing to develop a third-order phase model and to translate all such processed data to the frequency realm for further analysis was described. The frequency study yields a long frequency modulation (FM) drift sinusoid (1600-sec period), an impressed secondary drift wave with a period of about 116 sec, and a set of even harmonics of twice the ramp period-the latter arising from, and used to modify, the phase detector model. The result is applied secondarily to estimate the strong-signal SSA phase detector response 'out-of-lock.' Finally, the main drift components are verified against all available data, and the result is used to estimate minimum lock conditions and the SSA drift effect under normal operating modes. The instability problem appears marginally resolvable if the acquisition technique is modified. Author

N76-15209* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS AND PREDICTION OF DOPPLER NOISE DURING SOLAR CONJUNCTIONS **c92**
A. L. Berman and S. T. Rockwell *In its* The Deep Space Network 15 Dec. 1975 p 231-263 refs (For availability see N76-15190 06-12)
CSCL 03B

The results of a study of Doppler data noise during solar conjunctions were presented. During the first half of 1975, a sizeable data base of Doppler data noise (estimates) for the Pioneer 10, Pioneer 11, and Helios 1 solar conjunctions was accumulated. To analyze this data, certain physical assumptions are made, leading to the development of a geometric parameter ('ISI') which correlates strongly with Doppler data noise under varying sun-earth-spacecraft geometries. Doppler noise models are then constructed from this parameter, resulting in the newfound ability to predict Doppler data noise during solar conjunctions, and hence to additionally be in a position to validate Doppler data acquired during solar conjunctions. Author

N76-15210* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CORRELATION OF DOPPLER NOISE DURING SOLAR CONJUNCTIONS WITH FLUCTUATIONS IN SOLAR ACTIVITY **c92**
A. L. Berman and S. T. Rockwell *In its* The Deep Space Network 15 Dec. 1975 p 264-272 refs (For availability see N76-15190 06-12)
CSCL 03B

Deviations betweeb observed Doppler noise and the noise model during solar conjunction were analyzed. It is tentatively concluded that these deviations are due to short-term fluctuations in solar activity as seen along the signal path, and not to solar/antenna structure effects or system noise temperature. Author

N76-15211* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING OPERATIONS DURING VIKING 1 LAUNCH PHASE **c17**
A. L. Berman and J. A. Wackley *In its* The Deep Space Network 15 Dec. 1975 p 273-290 refs (For availability see N76-15190 06-12)
CSCL 22D

The prelaunch planning and subsequent analysis of tracking operations during the Viking 1 launch phase were described. The launch phase tracking procedures were intensively considered and conservatively designed to accommodate even the most unfavorable of launch possibilities. These procedures were successfully implemented and strongly contributed to the highly successful launch of Viking 1. Author

N76-15212* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A RELATIONAL DATA BASE IMPLEMENTED USING MBASIC **c60**
R. M. Smith *In its* The Deep Space Network 15 Dec. 1975 p 291-305 refs (For availability see N76-15190 06-12)
CSCL 09B

The implementation of a relational data base in MBASIC was described. Five relational operations were implemented, and their use on two data bases is described. Author

N76-15213# European Space Agency, Paris (France).
REMOTE SENSING FROM SPACELAB: A CASE FOR INTERNATIONAL COOPERATION
J. Plevin 1974 32 p refs Presented at the 2d Symp. on Remote Sensing of Man's Environ., Bristol, Engl., Sep. 1974
Avail: NTIS HC $4.00

A brief description is given of the Spacelab system and ideas on its role in earth resources surveys from space. The need for cooperative action is mentioned and arguments presented to show that the basis of cooperation needs to be established now if effective use is to be made of the potential of Spacelab and the automatic operational satellites that will follow. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-15214*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMS/SATELLITE SITUATION CENTER REPORT
Jun. 1973 42 p
(NASA-TM-X-72585; Rept-1) Avail: NTIS HC $4.00 CSCL 22C

Services planned by the Satellite Situation Center during the International Magnetospheric Study are briefly described. User requirements are emphasized. The following data are presented: orbital parameters for ISIS 2, ESRO 4, and HEOS 2; entry exit times for highly elliptical satellites; plots for highly elliptical earth satellites; and plots and flux tube intersection for low altitude satellites. J.M.S.

N76-15215*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMS/SATELLITE SITUATION CENTER REPORT. PREDICTED ORBIT PLOTS FOR HAWKEYE 1, 1976
Dec. 1975 192 p refs
(NASA-TM-X-72586; Rept-2) Avail: NTIS HC $7.50 CSCL 22C

The predicted orbit plots are shown in three projections. The time period covered by each set of projections is 2 days 1 hour, corresponding approximately to the period of Hawkeye 1. The three coordinate systems used are the Geocentric Solar Ecliptic system (GSE), the Geocentric Solar Magnetospheric system (GSM), and the Solar Magnetic system (SM). For each of the three projections, time ticks and codes are given on the satellite trajectories. The codes are interpreted in the table at the base of each plot. Time is given in the table as year/day/

decimal hour. The total time covered by each plot is shown at the bottom of each table, and an additional variable is given in the table for each time tick. For the GSM and SM projection this variable is the geocentric distance to the satellite in earth radii, and for the GSE projection the variable is satellite ecliptic latitude in degrees. Author

N76-15216*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMS/SATELLITE SITUATION CENTER REPORT. PREDICTED ORBIT PLOTS FOR IMP-H-1976
Dec. 1975 54 p ref
(NASA-TM-X-72587; Rept-3) Avail: NTIS HC $4.50 CSCL 22C

Predicted orbit plots are shown in three projections. The time period covered by each set of projections is 12 days 6 hours, corresponding approximately to the period of IMP-H satellite. The three coordinate systems used are the Geocentric Solar Ecliptic system (GSE), the Geocentric Solar Magnetospheric system (GSM), and the Solar Magnetic system (SM). For each of the three projections, time ticks and codes are given on the satellite trajectories. The codes are interpreted in the table at the base of each plot. Time is given in the table as year/day/decimal hour. The total time covered by each plot is shown at the bottom of each table. An additional variable is given in the table for each time tick. For the GSM and SM projection this variable is the geocentric distance to the satellite in earth radii, and for the GSE projection the variable is satellite ecliptic latitude in degrees. Author

N76-15217*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMS/SATELLITE SITUATION CENTER REPORT: PREDICTED ORBIT PLOTS FOR IMP-J-1976
Dec. 1975 52 p ref
(NASA-TM-X-72588; Rept-4) Avail: NTIS HC $4.50 CSCL 22C

Predicted orbit plots for the IMP-J satellite were given for the time period January-December 1976. These plots are shown in three projections. The time period covered by each set of projections is 12 days and 6 hours, corresponding approximately to the period of IMP-J. The three coordinate systems used are the Geocentric Solar Ecliptic system (GSE), the Geocentric Solar Magnetospheric system (GSM), and the Solar Magnetic system (SM). For each of the three projections, time ticks and codes are given on the satellite trajectories. The codes are interpreted in the table at the base of each plot. Time is given in the table as year/day/decimal hour, and the total time covered by each plot is shown at the bottom of each table. Author

N76-15218*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMS/SATELLITE SITUATION CENTER REPORT. SPECIAL IMS PERIODS FOR 1976
Dec. 1975 115 p refs
(NASA-TM-X-72590; Rept-6) Avail: NTIS HC $5.50 CSCL 22C

Special International Magnetospheric Study (IMS) Satellite Periods selected at times when two or more satellites are expected to be in interesting regions of the magnetosphere simultaneously are described. Data are presented to aid in defining a program of magnetospheric observations which emphasizes coordinated measurements of satellites, rockets, balloons, aircraft, and ground-based stations. The position is given of currently operating high altitude spacecraft in the Geocentric Solar Ecliptic, Geocentric Solar Magnetospheric, and Solar Magnetic coordinate systems to determine their passage through the bow shock, the magnetopause, the cusp, or the neutral sheet region. Information on the synchronous and low altitude spacecraft and experiments are included in tabular form along with a tabular summary of all the rocket, balloon, and aircraft campaigns in 1976. J.M.S.

N76-15219*# Virginia Univ., Charlottesville. Leander McCormick Observatory.
A TWO PARAMETER SURVEY OF PERIODIC ORBITS IN THE RESTRICTED PROBLEM OF THREE BODIES
Peter J. Shelus [1975] 40 p refs
(Grant NGR-47-005-138)
(NASA-CR-146066) Avail: NTIS HC $4.00 CSCL 22C

Within the context of the restricted problem of three bodies the effects caused by varying the mass ratio of the primaries and the eccentricity of their orbits, upon periodic orbits of the infinitesimal mass which are numerical continuations of circular orbits in the ordinary problem of two bodies are shown. A recursive power series technique is used to numerically integrate the equations of motion as well as the first variational equations in order to generate a two parameter family of perodic orbits and identify the linear stability characteristics. Seven such families are investigated with equally spaced mass ratios from 0.0 to 1.0 and eccentricities of the orbits of the primaries in a range 0.0 to 0.6. Stable orbits are associated with large distances of the infinitesimal mass from the perturbing primary, nearly circular motion of the primaries, and small mass ratios of the primaries. Unstable orbits for the infinitesimal mass are associated with small distances from the perturbing primary, highly elliptic orbits of the primaries and large mass ratios. Author

N76-15220*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATUS OF AVAILABILITY OF ZOND 8 (1970-088A) LUNAR PHOTOGRAPHY
Jan. 1976 4 p
(NASA-TM-X-72591; NSSDC/WDC-A-R/S-76-01) Avail: NTIS HC $3.50 CSCL 22C

The availability is announced of selected Zond 8 photographs from the National Space Science Data Center/World Data Center A for Rockets and Satellites (NSSDC/WDC-A-R&S). Procedures for ordering these data are included. Author

N76-15221# Buero fuer Angewandte Mathematik und Elektronische Datenverarbeitung, Zurich (Switzerland).
THE UTILIZATION OF REGULARIZED COORDINATES FOR THE DIFFERENTIAL CORRECTION OF SPACECRAFT TRAJECTORIES Final Report
Apr. 1974 126 p refs 2 Vol.
(Contract ESA-419/72-AR)
(ESA-CR(P)-462) Avail: NTIS HC $6.00

The applicability of the regularized coordinate method using the Kustaanheimo-Stiefel transform for differential correction of spacecraft trajectories was investigated with regard to accuracy and computing speed. The differential equations for the orbit and its variations are set up in the four-dimensional U space using the generalized eccentric anomaly as independent variable. Perturbations considered are third body attraction, oblateness, inhomogeneities of the central body, and air drag. A numerical integration procedure by iteration was then established. The correction process was studied in U space and in three-dimensional physical X space. It is shown that the integration of the equations may be performed with 50% gain in computing time for circular orbits and more for highly eccentric orbits while a considerable accuracy improvement is obtained. ESA

N76-15222# Buero fuer Angewandte Mathematik und Elektronisvhe Datenverarbeitung, Zurich (Switzerland).
THE UTILIZATION OF REGULARIZED COORDINATES FOR THE DIFFERENTIAL CORRECTION OF SPACECRAFT TRAJECTORIES. DOCUMENTATION OF PROGRAMS PREPARED IN CONNECTION WITH THE STUDY
Apr. 1974 101 p 2 Vol.
(Contract ESA-419/72-Ar)
(ESA-CR(P)-463) Avail: NTIS HC $5.50

Computer programs for the calculation of orbits and partial derivatives are presented using regularized equations of motion and variational equations for the expression of spacecraft trajectories and their differential correction. The programs are based on the use of the Kustaanheimo-Stiefel coordinate transform with generalized eccentric anomaly as in dependent anomaly. The disturbing trajectory forces considered are earth asphericity, moon's attraction, and drag. They may be introduced in arbitrary combinations. The programs were developed on a CDC 6400/6500 computer using FORTRAN 4 in single precision. ESA

N76-15223# Analytical and Computational Mathematics, Zurich (Switzerland).
AN ANALYTICAL STATE TRANSITION MATRIX FOR

SATELLITES PERTURBED BY THE OBLATENESS AND BY A THIRD BODY
O. Graf and G. Scheifele Sep. 1975 69 p refs
(Contract ESOC-651/74-AR)
(ESA-CR(P)-728) Avail: NTIS HC $4.50

A canonical analytical solution for perturbing equations based on new two body elements of the Delaunay Similar type was discussed. The state transition matrix is based on the analytical solution used previously by Scheifele. Numerical results show that it is worthwhile to take the perturbations due to the J sub 2 term into account for the derivation of the transition matrix. For most neigboring orbits the forward mapping of the state yields about two digits more accuracy over a few revolutions of compound with the pure two body matrix. ESA

N76-15224*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMS/SATELLITE SITUATION CENTER REPORT. PREDICTED ORBIT PLOTS FOR VELA 5B, 1976
Dec. 1975 100 p ref
(NASA-TM-X-72589; Rep-5) Avail: NTIS HC $5.00 CSCL 22C

Predicted orbit plots for the Vela 5B satellite are presented for the time period January-December 1976. This satellite has been identified as an important possible contributor to the International Magnetospheric Study (IMS) project. The predicted orbit plots are shown in three projections. The time period covered by each set of projections is 4 days 16 hours, corresponding approximately to the period of Vela 5B. The three coordinate systems used are the Geocentric Solar Ecliptic system (GSE), the Geocentric Solar Magnetospheric system (GSM), and the Solar Magnetic system (SM). Author

N76-15225# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
ADVANCED GUIDANCE TECHNOLOGY PROGRAM, VOLUME 1 Semiannual Technical Report, Aug. 1974 - Feb. 1975
Apr. 1975 109 p refs
(Contract F04701-74-C-0343)
(AD-A014318; R-872-Vol-1; SAMSO-TR-75-153-Vol-1) Avail: NTIS CSCL 17/7

The document reports on progress during the first six months of the Advanced Guidance Technology program. Five general areas are discussed: (1) Microelectronics packaging, (2) Digital Inertial Measurement Unit Electronics, (3) Dormancy and rapid readiness, (4) Inertial component technology for the reentry guidance mission, and (5) System implications of terminal aids. All work done in the program relates to guidance technologies applicable to maneuvering reentry vehicles. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N76-15226*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF SAFETY IMPLICATIONS FOR SHUTTLE LAUNCHED SPACECRAFT USING FLUORINATED OXIDIZERS. VOLUME 1: COMPLETE TEXT Final Report
Nov. 1975 263 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954034)
(NASA-CR-146063) Avail: NTIS HC $9.00 CSCL 22D

The safety implications of space shuttle launched spacecraft using liquid flourine as the oxidizer for spacecraft propulsion were investigated. Feasibility of safe operation was investigated and the equipment and procedures necessary to maximize the chance of success determined. Hazards to the shuttle were found to be similar in kind if not degree to those encountered in use of nitrogen tetroxide (also toxic oxidizer). It was concluded that residual risks from spacecraft using fluorine and nitrogen tetroxide during ground and flight handling may be reduced by isolation of the oxidizer to only its tank. Operation of planetary spacecraft propulsion in the vicinity of the shuttle in earth orbit is not required. The primary hazard to personnel was identified as propellant loading operations, which should be accomplished in an area reasonably remote from personnel and facilities concentrations. Clearing the pad during spacecraft mating with the shuttle orbiter is recommended. Author

N76-15227*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF SAFETY IMPLICATIONS FOR SHUTTLE LAUNCHED SPACECRAFT USING FLUORINATED OXIDIZERS. VOLUME 2: EXECUTIVE SUMMARY Final Report
Nov. 1975 44 p ref Prepared for JPL
(Contracts NAS7-100; JPL-954034)
(NASA-CR-146062) Avail: NTIS HC $4.00 CSCL 22D

An abbreviated version of the conclusions dealing with the safety implications of using liquid fluorinated oxidizers on space shuttle launched spacecraft was presented. The complete version was presented in volume 1. Author

N76-15228# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).
DYNALPIC BED MEASUREMENTS OF THE LOSSES OF SPECIFIC IMPULSE DUE TO THE PRESENCE OF A SOLID PHASE IN THE GAS FLOW OF A PROPULSIVE NOZZLE MODEL [MESURE AU BANC DYNALPIQUE DE LA PERTE D'IMPULSION SPECIFIQUE DUE A LA PRESENCE D'UNE PHASE SOLIDE DANS L'ECOULEMENT GAZEUX D'UNE MAQUETTE DE TUYERE PROPULSIVE]
Jean Macquet Paris Assoc. Aeron. et Astronautique de France 1975 24 p In FRENCH Presented at the 11th Assoc. Aeron. et Astronautique de France Colloq. d'Aerodyn. Appl., Bordeaux, 6-8 Nov. 1974
(AAAF-NT-75-8; ISBN-2-7170-0326-6) Avail: NTIS HC $3.50; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Equipment was developed to investigate the losses of specific impulse on an aluminum loaded power rocket propellant engine. This equipment, including a differential balance to measure the specific impulse and a solid particle injector, is described; its operational principles are presented, and error analysis is discussed. Results from the theory and from experiments are compared and discussed. The performance of the dynalpic bed method for specific impulse measurements is emphasized. The errors were found interior to those predicted by the theory. ESA

N76-15191* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Dec. 1975 p 1-4 (For availability see N76-15190 06-12)
CSCL 14B

N76-15192* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TEST AND TRAINING SYSTEM
H. C. Thorman *In its* The Deep Space Network 15 Dec. 1975 p 5-15 refs (For availability see N76-15190 06-12)
CSCL 14B

N76-15194* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT
D. J. Mudgway and D. W. Johnston *In its* The Deep Space Network 15 Dec. 1975 p 57-60 ref (For availability see N76-15190 06-12)
CSCL 22D

N76-15195* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Dec. 1975 p 61-64 ref (For availability see N76-15190 06-12)
CSCL 22D

N76-15196* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, W. G. Meeks, R. E. Morris, and S. E. Reed *In its* The Deep Space Network 15 Dec. 1975 p 65-69 ref (For availability see N76-15190 06-12)
CSCL 22D

N76-15203* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A VERSATILE DATA ACQUISITION SYSTEM FOR GOLDSTONE
M. S. Reid and R. A. Gardner *In its* The Deep Space Network 15 Dec. 1975 p 132-143 refs (For availability see N76-15190 06-12)
CSCL 14B

N76-15207* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT
E. B. Jackson *In its* The Deep Space Network 15 Dec. 1975 p 214-221 ref (For availability see N76-15190 06-12)
CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-15229*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT-1 AND LANDSAT-2 EVALUATION REPORT, 23 JANUARY 1975 TO 23 APRIL 1975
15 Aug. 1975 260 p
(Contract NAS5-21808)
(NASA-CR-144696; Doc-75SDS4228) Avail: NTIS HC $9.00 CSCL 22B

A description of the work accomplished with the Landsat-1 and Landsat-2 satellites during the period 23 Jan. - 23 Apr. 1975 was presented. The following information was given for each satellite: operational summary, orbital parameters, power subsystem, attitude control subsystem, command/clock subsystem, telemetry subsystem, orbit adjust subsystem, magnetic moment compensating assembly, unified S-band/premodulation processor, electrical interface subsystem, thermal subsystem, narrowband tape recorders, wideband telemetry subsystem, attitude measurement sensor, wideband video tape recorders, return beam vidicon, multispectral scanner subsystem, and data collection subsystem. Y.J.A.

N76-15230*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AND TRANSONIC DYNAMIC STABILITY CHARACTERISTICS OF A SPACE SHUTTLE ORBITER
Richmond P. Boyden and Delma C. Freeman, Jr. Washington Nov. 1975 176 p refs
(NASA-TN-D-8042; L-10304) Avail: NTIS HC $7.50 CSCL 22B

Subsonic and transonic forced oscillation tests of a 0.0165-scale model of a modified 089B space shuttle orbiter were made in the Langley 8-foot transonic pressure tunnel. The period and damping of the basic unaugmented vehicle were calculated along the entry trajectory utilizing these measured dynamic data. Some parameter analyses were made with the measured dynamic derivatives. Author

N76-15231* National Aeronautics and Space Administration, Washington, D.C.
SECOND INTELSAT IV-A COMMUNICATIONS SATELLITE SET FOR LAUNCH
[1976] 10 p
(NASA-News-Release-76-8; P76-1001) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22D

The scheduled launching of INTELSAT 4-A is announced. It is a commercial communications satellite to be launched aboard an Atlas/Centaur Launch Vehicle from the Kennedy Space Center, Fla. The satellite has the capability of carrying approximately 6250 two-way telephone conversations. F.O.S.

N76-15232*# General Electric Co., Philadelphia, Pa.
EARTH OBSERVATORY SATELLITE (EOS) SYSTEM DEFINITION STUDY Executive Summary
Nov. 1974 20 p
(Contract NAS5-20518)
(NASA-CR-144715; EOS-410-07) Avail: NTIS HC $3.50 CSCL 22B

An executive summary of a study on the Earth Observatory Satellite (EOS) was presented. It was concluded that the overall costs of space systems could be reduced significantly by the development of a modular shuttle compatible standard spacecraft, and the use of that spacecraft with the Shuttle Transportation System. It was also demonstrated that the development of the standard spacecraft is feasible, desirable, and cost effective if applied to a series of missions. The ability to initially retrieve, refurbish, and reuse the spacecraft and its payload, and ultimately to perform in-orbit servicing, would result in significant cost savings. A number of specific conclusions and recommendations were also suggested. Author

N76-15233# Battelle Inst., Frankfurt am Main (West Germany).
ASSESSMENT OF THE RESULTS OF THE SKYLAB SPACE PROCESSING EXPERIMENTS WITH RESPECT TO THEIR SCIENTIFIC-TECHNICAL SIGNIFICANCE Final Report
R. Beck, K. H. Gruenthaler, D. N. Sethna, R. Tschulena, and H. Winter Oct. 1974 61 p refs
(Contract ESA-SC/43/RQ)
(ESA-CR(P)-623) Avail: NTIS HC $4.50

The Skylab experiments (series M512 and M518) were assessed on the basis of information available in various publications as well as through consultation with experts in the fields of materials science and space processing. Conclusions and recommendations are given for metals and alloys (melting, exothermic brazing, sphere forming, immiscible alloy compositions), composite materials (whiskers in metal matrix, pores in metal matrix, aligned eutectics), and the growth of single crystals. ESA

N76-15234# Hawker Siddeley Dynamics Ltd., Hatfield (England).
ESRO 4 IN ORBIT Final Report
R. S. Pym, comp. [1975] 139 p
(Contract ESTEC-1763/72)
(HSD-TN-4279; ESA-CR(P)-709) Avail: NTIS HC $6.00

Orbital activities and operations performed on the ESSA 4 satellite from launch in November 1972 to reentry in April 1974 were described. The spacecraft operated correctly for the 17 months in orbit and experiment data were obtained for 1410 hours in real time at a low speed rate, 312 hours at playback rate, and 179 hours in real time high speed rate. Due to increased power available (albedo, less degradation, etc.) the experiments were not switched on and off according to the original mission plan. Twenty maneuvers were executed instead of the originally planned 9. Tests performed on the battery indicated that the capacity was about 3.4 Ahr at the end of its life. ESA

N76-15235# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
COMPARISON BETWEEN NAVAL SURFACE WEAPONS CENTER AND NAVY ASTRONAUTICS GROUP EPHEMERIDES FOR GEOCEIVER POSITIONING Final Technical Report
Haschal L. White, Donovan N. Huber, and Jerry L. Taylor May 1975 34 p refs
(AD-A014416; DMAAC-TR-75-001) Avail: NTIS CSCL 22/3

Current procedures for GEOCEIVER positioning use GEOCEIVER tracking data in conjunction with Navy Navigation Satellite (NNS) ephemerides as produced by the Naval Surface Weapons Center (NSWC) and based on a worldwide tracking system. The Navy Astronautics Group (NAVASTROGRU) also produces ephemerides for these satellites in near real time but based on a four station tracking net (OPNET). These study results indicate that GEOCEIVER coordinate differences of about ten meters can be expected when the NAVASTROGRU ephemerides are substituted for the NSWC produced ephemerides. Orbit comparisons show Root Mean Square radial, intrack and crosstrack differences averaging about 10, 25 and 15 meters, respectively. Although these differences could be reduced by applying a more suitable transformation to the NAVASTROGRU ephemerides, best agreement would be achieved if a common gravitational model and OPNET station coordinate set were used. This should be achieved when current plans to use the World Geodetic System 1972 gravitational model and OPNET station

coordinate set in NAVASTROGRU ephemerides computations are implemented. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N76-15236*# Linkabit Corp., San Diego, Calif.
DIGITAL TV PROCESSING SYSTEM
26 Nov. 1975 123 p refs
(Contract NAS9-14561)
(NASA-CR-147393) Avail: NTIS HC $5.50 CSCL 17B

Two digital video data compression systems directly applicable to the Space Shuttle TV Communication System were described: (1) For the uplink, a low rate monochrome data compressor is used. The compression is achieved by using a motion detection technique in the Hadamard domain. To transform the variable source rate into a fixed rate, an adaptive rate buffer is provided. (2) For the downlink, a color data compressor is considered. The compression is achieved first by intra-color transformation of the original signal vector, into a vector which has lower information entropy. Then two-dimensional data compression techniques are applied to the Hadamard transformed components of this last vector. Mathematical models and data reliability analyses were also provided for the above video data compression techniques transmitted over a channel encoded Gaussian channel. It was shown that substantial gains can be achieved by the combination of video source and channel coding. Author

N76-15237# Ferranti, Ltd., Bracknell (England).
AUTOMATIC LASER TRACKING SYSTEM: DIGITAL CONTROL AND SIMULATION
Elie Haziza [1974] 189 p refs Original report in FRENCH previously announced as N73-24190
(ONERA-TN-198) Avail: NTIS HC $7.50

An angular position servo system, having a unitary return and including a digital computer in its control chain, was developed as part of an automatic laser tracking system. A tracking program which was to serve as a basis for the first trials of the complete equipment at the firing range was edited. A real time control program, written to minimize computer times, provides the target angular velocities, ensures the echo validation and takes into account a possible loss of echo. The input data includes the pointing error (quantified with only five possible values) and the position of the turret (provided by optical encoders). The simulation program permitted, after real tests, improvements of the control program, either by reducing the cost function, or by passing from first to second order the velocity error estimation. ESA

N76-15238# Hawker Siddeley Dynamics Ltd., Stevenage (England). Space Div.
REPORT ON THE DEVELOPMENT OF AN S-BAND BUTLER MATRIX
Z. F. Voyner, comp. May 1973 283 p refs
(Contract ESTEC-1216/70-AA)
(HSD-TP-7387; ESA-CR(P)-436) Avail: NTIS HC $9.25

The development of an S-band Butler beam-forming matrix for satellite telemetry was discussed. The matrix is used for feeding a 16 x 16 array of radiators arranged on a circular cylinder, to produce narrow beams in the azimuthal plane. (Two identical matrices may be used to produce a 32 x 32 beam-forming network). It represents a passive reciprocal network and consists of 3dB couplers, fixed phase shifters, and interconnecting strip transmission lines. The development was carried out with the object of producing a design which could be space qualified at a later date. The initial study, development, and production of the matrix are detailed. ESA

N76-15239# Defense Communications Engineering Office, Reston, Va.
CONTROL METHODOLOGY FOR DEMAND ASSIGNMENT OPERATION OF SATELLITE NETS
Nicholas Kyriakopoulos Mar. 1975 44 p refs
(AD-A014079; TN-12-75) Avail: NTIS CSCL 17/2

The Defense Communication System (DCS) is an integrated terrestrial and satellite communications system. This report is concerned with the DCS satellite nets which consist of several collections of earth terminals each served by a single spacecraft. There are fundamental differences between the control of commercial and military satellite nets. Network control attains added significance when demand assignment is introduced into the system. As a first step toward the development of a control methodology for the DSCS, a brief review of current and planned multiple access commercial communications systems is presented. It is hoped that subsequent studies will examine similarities and differences between the commercial and military environments. As a result of such analyses a control methodology can hopefully be devised. This report is intended as a small contribution toward the development of a control model for the DSCS. GRA

N76-15240# Geological Survey, Reston, Va.
WORLDWIDE DISASTER WARNING AND ASSESSMENT WITH EARTH RESOURCES TECHNOLOGY SATELLITES Final Report
Charles J. Robinove Aug. 1975 71 p
(PB-244382/8; USGS-GD-75-017; IR-NC-47) Avail: NTIS HC $4.50 CSCL 13L

On the basis of experimental results, the potential use of Earth Resources Technology Satellites (ERTS) for worldwide disaster or monitoring and the techniques used for application of ERTS data to disaster monitoring and analysis are described. Problems and recommended solutions to arrive at an operational disaster monitoring capability are presented. GRA

N76-15193* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUMMARY REPORT ON THE VIKING 1975 DSN TELECOMMUNICATIONS COMPATIBILITY TEST PROGRAM
A. I. Bryan *In its* The Deep Space Network 15 Dec. 1975 p 16-56 ref (For availability see N76-15190 06-12)
CSCL 17B

N76-15197* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW GLOBAL IONOSPHERIC MODEL
K. W. Yip and O. H. VonRoos *In its* The Deep Space Network 15 Dec. 1975 p 70-87 refs (For availability see N76-15190 06-12)
CSCL 17B

N76-15206* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM PERFORMANCE WITH CONVOLUTIONALLY CODE DATA
B. D. L. Mulhall, B. Benjauthrit, C. A. Greenhall, D. M. Kuma, J. K. Lam, J. S. Wong, J. Urech, and L. D. Vit *In its* The Deep Space Network 15 Dec. 1975 p184-213 refs (For availability see N76-15190 06-12)
CSCL 17B

N76-15211* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING OPERATIONS DURING VIKING 1 LAUNCH PHASE
A. L. Berman and J. A. Wackley *In its* The Deep Space Network 15 Dec. 1975 p 273-290 refs (For availability see N76-15190 06-12)
CSCL 22D

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-15241*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
SPACE SHUTTLE ON-ORBIT FLIGHT CONTROL SOFTWARE REQUIREMENTS, PRELIMINARY VERSION
Dec. 1975 219 p
(Contract NAS9-13809)
(NASA-CR-147397; C-4546) Avail: NTIS HC $7.75 CSCL 22B

Software modules associated with various flight control functions for the space shuttle orbiter are described. Data flow, interface requirements, initialization requirements and module sequencing requirements are considered. Block diagrams and tables are included. D.M.L.

N76-15242*# Analytic Sciences Corp., Reading, Mass.
SPACE SHUTTLE POST-ENTRY AND LANDING ANALYSIS. VOLUME 1: CANDIDATE SYSTEM EVALUATIONS
Bard S. Crawford and Edward M. Duiven 20 Jul. 1973 202 p refs
(Contract NAS9-12968)
(NASA-CR-144647; TR-302-1-Vol-1) Avail: NTIS HC $7.75 CSCL 22C

The general purpose of this study is to aid in the evaluation and design of multi-sensor navigation schemes proposed for the orbiter. The scope of the effort is limited to the post-entry, energy management, and approach and landing mission phases. One candidate system based on conventional navigation aids is illustrated including two DME (Distance Measuring Equipment) stations and ILS (Instrument Landing System) glide slope and localizer antennas. Some key elements of the system not shown are the onboard IMUs (Inertial Measurement Units), altimeters, and a computer. The latter is programmed to mix together (filter) the IMU data and the externally-derived data. A completely automatic, all-weather landing capability is required. Since no air-breathing engines will be carried on orbital flights, there will be no chance to go around and try again following a missed approach. Author

N76-15243*# Analytic Sciences Corp., Reading, Mass.
SPACE SHUTTLE POST-ENTRY AND LANDING ANALYSIS. VOLUME 2: APPENDICES
Bard S. Crawford and Edward M. Duiven 20 Jul. 1973 137 p
(Contract NAS9-12968)
(NASA-CR-144648; TR-302-1-Vol-2) Avail: NTIS HC $6.00 CSCL 22C

Four candidate navigation systems for the space shuttle orbiter approach and landing phase are evaluated in detail. These include three conventional navaid systems and a single-station one-way Doppler system. In each case, a Kalman filter is assumed to be mechanized in the onboard computer, blending the navaid data with IMU and altimeter data. Filter state dimensions ranging from 6 to 24 are involved in the candidate systems. Comprehensive truth models with state dimensions ranging from 63 to 82 are formulated and used to generate detailed error budgets and sensitivity curves illustrating the effect of variations in the size of individual error sources on touchdown accuracy. The projected overall performance of each system is shown in the form of time histories of position and velocity error components. Author

N76-15244*# Chrysler Corp., New Orleans, La. Space Div.
ENTRY HEAT TRANSFER TESTS OF THE 0.006-SCALE SPACE SHUTTLE ORBITER MODEL (50-0) IN LANGLEY RESEARCH CENTER FREON TUNNEL AT MACH 6 (OH45) Aerothermodynamic Data Report.
J. W. Foust (Rockwell Intern. Corp., Downey, Calif.) Dec. 1975 228 p refs
(Contract NAS9-13247)
(NASA-CR-141527; DMS-DR-2109) Avail: NTIS HC $8.00 CSCL 22B

Results are presented of heat transfer tests of a 147B configuration orbiter model (50-0) conducted in the NASA Langley Research Center Freon Tunnel (LRC/CF4). These tests were conducted at a nominal Mach number of 6, and at Reynolds numbers of 0.3 and 0.5 x 1,000,000 per foot. The objectives of the tests were to determine the effects of the low freon specific heat ratio, gamma, on the heating distributions and to determine the impingement of the orbiter bow shock on the wing. The data presented include thin skin heat transfer data (tabulated data and plotted data). Author

N76-15245*# Chrysler Corp., New Orleans, La. Space Div.
LOW SUPERSONIC STABILITY AND CONTROL CHARACTERISTICS OF .015-SCALE (REMOTELY CONTROLLED ELEVON) MODEL 44-0 OF SPACE SHUTTLE ORBITER TESTS IN NASA/LARC 4-FT UPWT (LEG 1) (LA63A) Aerothermodynamic Data Report
Joe D. Gamble (NASA. Lyndon B. Johnson Space Center) Nov. 1975 219 p
(Contract NAS9-13247)
(NASA-CR-144579; DMS-DR-2270) Avail: NTIS HC $7.75 CSCL 22B

A Langley-built 0.015-scale Space Shuttle Orbiter model with remote independently operated left and right elevon surfaces was tested. The objective of the test was to generate a detailed aerodynamic data base for the current shuttle orbiter configuration. Special attention was directed to definition of nonlinear aerodynamic characteristics by taking data at small increments in angle of attack, angle of sideslip, and elevon position. Six-component aerodynamic force and moment and elevon position data were recorded over an angle of attack range from -2 deg to 20 deg at angles of sideslip of 0 deg and plus or minus 2 deg. Additional tests were made over an angle of range from -6 deg to 8 deg at selected angles of attack. The test Mach numbers were 1.5 and 2.0 while the Reynolds number held at a constant two million per foot. Photographs of the test configuration are shown. Author

N76-15246*# Chrysler Corp., New Orleans, La. Data Management Services.
RESULTS OF A PRESSURE LOADS INVESTIGATION ON A 0.030-SCALE MODEL (47-OTS) OF THE INTEGRATED SPACE SHUTTLE VEHICLE CONFIGURATION 5 IN THE NASA AMES RESEARCH CENTER 11 BY 11 FOOT LEG OF THE UNITARY PLAN WIND TUNNEL (IA81A)
E. Chee (Rockwell Intern. Corp., Downey, Calif.) Nov. 1975 933 p
(Contract NAS9-13247)
(NASA-CR-141836; DMS-DR-2169-Vol-1) Avail: NTIS HC $23.75 CSCL 22B

Results of wind tunnel tests on a 0.030-scale model of the integrated space shuttle vehicle configuration 5 are presented. Testing was conducted in the NASA Ames Research Center 11 x 11 foot leg of the Unitary Plan Wind Tunnel to investigate pressure distributions for airloads analyses at Mach numbers from 0.9 through 1.4. Angles of attack and sideslip were varied from -6 to +6 degrees. Author

N76-15247*# Chrysler Corp., New Orleans, La. Data Management Services.
RESULTS OF A PRESSURE LOADS INVESTIGATION ON A 0.030-SCALE MODEL (451-OTS) OF THE INTEGRATED SPACE SHUTTLE VEHICLE CONFIGURATION 5 IN THE NASA AMES RESEARCH CENTER 11 BY 11 FOOT LEG OF THE UNITARY PLAN WIND TUNNEL (IA81A), VOLUME 2
E. Chee (Rockwell Intern. Corp., Downey, Calif.) Nov. 1975 817 p
(Contract NAS9-13247)
(NASA-CR-141837; DMS-DR-2169-Vol-2) Avail: NTIS

HC $21.25 CSCL 22B

Tabulated force data and plotted pressure data are presented on a scale model of the integrated space shuttle vehicle configuration. For Vol. 1, see N76-15246. J.M.S.

N76-15248*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF A PRESSURE LOADS INVESTIGATION ON A 0.030-SCALE MODEL (47-OTS) OF THE INTEGRATED SPACE SHUTTLE VEHICLE CONFIGURATION 5 IN THE NASA AMES RESEARCH CENTER 11 X 11 FOOT LEG OF THE UNITARY PLAN WIND TUNNEL (IA81A), VOLUME 3
E. Chee (Rockwell Intern. Corp., Downey, Calif.) Nov. 1975 704 p
(Contract NAS9-13247)
(NASA-CR-141838; DMS-DR-2169-Vol-3) Avail: NTIS HC $18.75 CSCL 22B

Tabulated pressure data are presented on the orbiter fuselage and left vertical tail surface of a scale model of the integrated space shuttle configuration. For Vol. 1, see N76-15246. J.M.S.

N76-15249*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF A PRESSURE LOADS INVESTIGATION ON A 0.030-SCALE MODEL (47-OTS) OF THE INTEGRATED SPACE SHUTTLE VEHICLE CONFIGURATION 5 IN THE NASA AMES RESEARCH CENTER 11 X 11 FOOT LEG OF THE UNITARY PLAN WIND TUNNEL (IA81A), VOLUME 4
E. Chee (Rockwell Intern. Corp., Downey, Calif.) Nov. 1975 730 p
(Contract NAS9-13247)
(NASA-CR-141839; DMS-DR-2169-Vol-4) Avail: NTIS HC $18.75 CSCL 22B

Tabulated pressure data are presented on the left lower wing surface of a scale model of the integrated space shuttle vehicle configuration. For Vol. 1, see N76-15246. J.M.S.

N76-15250*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF A PRESSURE LOADS INVESTIGATION ON A 0.030-SCALE MODEL (47-OTS) OF THE INTEGRATED SPACE SHUTTLE VEHICLE CONFIGURATION 5 IN THE NASA AMES RESEARCH CENTER 11 X 11 FOOT LEG OF THE UNITARY PLAN WIND TUNNEL (IA81A), VOLUME 5
E. Chee (Rockwell Intern. Corp., Downey, Calif.) Nov. 1975 774 p
(Contract NAS9-13247)
(NASA-CR-141840; DMS-DR-2169-Vol-5) Avail: NTIS HC $18.75 CSCL 01A

Tabulated pressure data are presented on the left upper wing surface of the integrated space shuttle vehicle configuration. For Vol. 1, see N76-15246. J.M.S.

N76-15251*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF A PRESSURE LOADS INVESTIGATION ON A 0.030-SCALE MODEL (47-OTS) OF THE INTEGRATED SPACE SHUTTLE VEHICLE, CONFIGURATION 5 IN THE NASA AMES RESEARCH CENTER 11 X 11 FOOT LEG OF THE UNITARY PLAN WIND TUNNEL (IA81A), VOLUME 6
E. Chee (Rockwell Intern. Corp., Downey, Calif.) Nov. 1975 775 p
(Contract NAS9-13247)
(NASA-CR-141841; DMS-DR-2169-Vol-6) Avail: NTIS HC $18.75 CSCL 01A

Tabulated pressure data are presented on the right upper wing surface, right lower wing surface, and SRM booster of the integrated space shuttle vehicle configuration. For Vol. 1, see N76-15246. J.M.S.

N76-15252*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF A PRESSURE LOADS INVESTIGATION ON A 0.030-SCALE MODEL (47-OTS) OF THE INTEGRATED SPACE SHUTTLE VEHICLE CONFIGURATION 5 IN THE NASA AMES RESEARCH CENTER 11 X 11 FOOT LEG OF THE UNITARY PLAN WIND TUNNEL (IA81A), VOLUME 7
E. Chee (Rockwell Intern. Corp., Downey, Calif.) Nov. 1975 692 p
(Contract NAS9-13247)
(NASA-CR-141842; DMS-DR-2169-Vol-7) Avail: NTIS HC $16.25 CSCL 01A

Tabulated pressure data are presented on the external tank and miscellaneous orifices of the integrated space shuttle vehicle configuration. For Vol. 1, see N76-15246. J.M.S.

N76-15253*# Chrysler Corp., New Orleans, La. Data Management Services.
HEAT TRANSFER TESTS OF A 0.006-SCALE THIN SKIN SPACE SHUTTLE MODEL (50-0, 41-T) IN THE LANGLEY RESEARCH CENTER NITROGEN TUNNEL AT MACH 19 (IH19)
D. G. Walstad (Rockwell Intern. Corp., Downey, Calif.) Nov. 1975 731 p
(Contracts NAS9-13247)
(NASA-CR-141822; DMS-DR-2157) Avail: NTIS HC $18.75 CSCL 22B

Data are presented from heat transfer tests on an 0.0006-scale space shuttle vehicle in the Langley Research Center Nitrogen Tunnel. The purpose of this test was to obtain ascent heating data at a high hypersonic Mach number. Configurations tested were integrated orbiter and external tank, orbiter alone, and external tank alone. All configurations were tested with and without boundary layer transition. Testing was conducted at a Mach number of 19, a Reynolds number of 0.5 million per foot, and angles of attack of 0, + or - 5, and + or - 10 degrees. Heat transfer data was obtained from 77 orbiter and 90 external tank iron-constantan thermocouples. Author

N76-15254# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
MATHEMATICAL MODEL OF THE SPIN AXIS DRIFT MOTION OF ESRO 2 AND 4 WITH SPECIAL REGARD TO AERODYNAMIC DRAG AND TO COMPARE THE PREDICTIVE CAPACITY OF MODEL PRODUCED
W. Hofmann 18 Jun. 1973 133 p refs
(Contract ESA-455/72-AR)
(ESA-CR(P)-461) Avail: NTIS HC $6.00

Attitude prediction of satellites is discussed with regard to aerodynamic drag torque modelling as applied to ESRO 2 and 4 satellites. A general model was established for near earth satellites with rotational symmetry based on physical modelling of the aerodynamic drag torque. This model is shown to be essential in order to avoid divergence of the attitude prediction error. It also forms a basis for radiation pressure torque modelling for which basic equations are given. A numerically simpler model derived by physical simplification is considered next, and compared to a spin axis drift model using torques constant over one orbit. Both these models are shown to be equivalent in respect to accuracy. A theory of sensitivity analysis to insufficiently known parameters is given. A comparison with ESRO 2 data shows that some high frequency, high amplitude oscillations still cannot be explained by any of the models considered. ESA

N76-15255# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
SATELLITE YAW ATTITUDE MEASUREMENT METHODS AND SYSTEMS STUDY Summary Report
Dec. 1974 30 p 2 Vol.
(Contract ESTEC-1780/72-AA)
(ESS/SS-616; ESA-CR(P)-629) Avail: NTIS HC $4.00

A review of the satellite yaw sensing problem was presented, and possible methods of obtaining a yaw attitude measurement were identified and subsequently assessed against twelve hypothetical missions representative of possible future ESA missions. The guidelines adopted for the study are: earth-pointing satellite orientation with small roll and pitch angles (less than 10 deg), nominally circular orbit (550 km to synchronous altitudes with inclinations from 0 deg to 90 deg), satellite momentum/non-momentum biased, mass 500 kg to 1000 kg, and with/without large solar arrays. The following systems are recommended: solar sensors, star sensors; gyro gimbal and rotor bearings; electronic components, processing electronics, microprocessors, and computers. ESA

N76-15256# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
SATELLITE YAW ATTITUDE MEASUREMENT METHODS AND SYSTEMS STUDY Final Report
Oct. 1971 316 p refs 2 Vol.

(Contract ESTEC-1780/72-AA)
(ESS/SS-597; ESA-CR(P)-630) Avail: NTIS HC $9.75
For abstract, see N76-15255.

N76-15257# Krupp (Fried.) G.m.b.H., Essen (West Germany).
EXPERIMENTAL WORK ON THE USE OF MEMORY ALLOY NiTi AS DRIVE FOR DEPLOYMENT OF ANTENNAS AND SOLAR CELL ARRAYS [EXPERIMENTALSTUDIE UEBER DIE MEMORY-LEGIERUNG NiTi ALS ANTRIEB FUER DIE ENTFALTUNG VON ANTENNEN ODER SOLARZELLENAUSLEGERN]
Frank Baumgart, Guenter Bensmann, Rainer Dietze, Joachim Jorde, Karl-Heinz Kramer, and Rudolf Mohs Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1975 89 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-RFT-1072; GfW-RV-11-TA-2/72)
(BMFT-FB-W-75-09) Avail: NTIS HC $5.00; ZLDI, Munich DM 18,70

The memory effect of the alloy NiTi can be utilized for converting heat into mechanical work. Since this is attributable to a transformation of the crystal structure, there is no chance of a failure occurring. The material makes possible the identity of drive and structural components. A deployment drive based on the memory alloy NiTi for antennas or solar cell arrays was developed. After the alloy was subjected to application-oriented investigations and tested for the optimum melting procedure and processing, and after a suitable deployment mechanism was developed, a working model of a deployable antenna was built and operated to demonstrate that this concept can be realized. Author (ESA)

N76-15258# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Technology Div.
PARAMETER ESTIMATION IN MATHEMATICAL MODELS OF THE ESRO 1A ATTITUDE DYNAMICS USING NUMERICAL DIFFERENTIATION OF MEASURED DATA
J. W. Boerstoel, G. H. Huizing, and P. T. L. M. VanWoerkom 4 Dec. 1972 81 p refs
(Contract ESOC-592/73-AR)
(NLR-TR-75029-C; ESA-CR(P)-724) Avail: NTIS HC $5.00

The validity of a new algorithm for the estimation of parameters related to torques on spacecraft torques is investigated. The algorithm is based on data reduction by numerical differentiation using smoothing splines. Measured data of the ESRO 1A Aurorae spacecraft are used. It was concluded that the new data reduction algorithm is stable and efficient. So-called end effects of the smoothing splines cause minor problems however. It was further concluded that the mathematical model for the spacecraft torques may be improved; better models are proposed. The algorithm appears to be a powerful tool for accurate estimation of in-orbit spacecraft torque parameters. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-15259*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REDUNDANCY MANAGEMENT OF MULTIPLE KT-70 INERTIAL MEASUREMENT UNITS APPLICABLE TO THE SPACE SHUTTLE
Lewis J. Cook 24 Nov. 1975 72 p refs
(NASA-TM-X-64971) Avail: NTIS HC $4.50 CSCL 22B

Results of an investigation of velocity failure detection and isolation for 3 inertial measuring units (IMU) and 2 inertial measuring units (IMU) configurations are presented. The failure detection and isolation algorithm performance was highly successful and most types of velocity errors were detected and isolated. The failure detection and isolation algorithm also included attitude FDI but was not evaluated because of the lack of time and low resolution in the gimbal angle synchro outputs. The shuttle KT-70 IMUs will have dual-speed resolvers and high resolution gimbal angle readouts. It was demonstrated by these tests that a single computer utilizing a serial data bus can successfully control a redundant 3-IMU system and perform FDI. Author

N76-15260*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
MAPPING X-RAY HELIOMETER FOR ORBITING SOLAR OBSERVATORY-8 Final Report
L. W. Acton and C. J. Wolfson Dec. 1975 91 p
(Contract NAS5-11360)
(NASA-CR-144710) Avail: NTIS HC $5.00 CSCL 14B

An instrument combining mechanical collimators and proportional counter detectors was designed to record solar X-rays with energies of 2-30 keV with good temperal, spectral, and spatial resolution. The overall operation of the instrument is described to the degree needed by personnel who interact with the experimenter during SC/experiment interfacing, experiment testing, observatory integration and testing, and pre/post launch data processing. The general layout of the instrument is given along with a summary of the instrument characteristics. Author

N76-15261*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A MINIATURIZED POINTING MOUNT FOR SPACELAB MISSIONS
Carl G. Fritz, T. Howell, Jr., P. D. Nicaise, and Joe R. Parker 25 Nov. 1975 69 p
(NASA-TM-X-64972) Avail: NTIS HC $4.50 CSCL 14B

A Miniaturized Pointing Mount (MPM) for Spacelab missions is defined and simulation results are described. This mount is proposed to complement the Spacelab Instrument Pointing System (IPS). It uses the same mount isolator concept as the Spacelab IPS but is much more efficient and economical for the accommodation of small shuttle payloads. The MPM is built from star tracker assemblies left over from the Apollo Telescope Mount program thereby assuring low cost and development risk. Simulation results indicate a high level of instrument stability can be expected. The short development time of the MPM would permit it to serve as a precursor to the Spacelab IPS for verifying critical new concepts such as the mount isolation and hold down mechanisms. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-15262 Purdue Univ., Lafayette, Ind.
MICROSTRUCTURAL BEHAVIOUR OF COPPER-ZIRCONIUM ALLOY RESULTING FROM ROCKET ENGINE IMPOSED THERMOMECHANICAL STRESSES Ph.D. Thesis
Adell Warren Brecheisen, II 1975 235 p
Avail: Univ. Microfilms Order No. 76-503

Materials used in the construction of high pressure, regeneratively cooled thrust chambers must have high thermal conductivity and must be able to retain their tensile properties at temperatures up to about 1000 F. Copper base alloys are candidates for this application due to their high thermal conductivity. The purpose of this program was to determine what changes in the microstructure of a candidate thrust chamber construction material would occur as the result of being exposed to a rocket engine environment for varying numbers of firing cycles and firing durations. The material chosen for study was copper-zirconium alloy (nominal 0.15 weight per cent zirconium). Water-cooled tubes constructed of copper-zirconium alloy were installed along the centerline of a rocket engine. Conditions of high temperature and pressure were imposed on the centerline tubes during engine operation. Dissert. Abstr.

N76-15263*# Lockheed Missiles and Space Co., Huntsville, Ala.
CHEMICALLY REACTING ONE-DIMENSIONAL GAS-PARTICLE FLOWS
James A. Tevepaugh and Morris M. Penny Oct. 1975 70 p refs
(Contract NAS9-14517)
(NASA-CR-147388; LMSC-HREC-TR-D390876) Avail: NTIS HC $4.50 CSCL 21H

The governing equations for the one-dimensional flow of a gas-particle system are discussed. Gas-particle effects are coupled via the system momentum and energy equations with the gas assumed to be chemically frozen or in chemical equilibrium. A computer code for calculating the one-dimensional flow of a gas-particle system is discussed and a user's input guide presented. The computer code provides for the expansion of the gas-particle system from a specified starting velocity and nozzle inlet geometry. Though general in nature, the final output of the code is a startline for initiating the solution of a supersonic gas-particle system in rocket nozzles. The startline includes gasdynamic data defining gaseous startline points from the nozzle centerline to the nozzle wall and particle properties at points along the gaseous startline. Author

N76-15264*# Rocketdyne, Canoga Park, Calif.
SSME MODEL, ENGINE DYNAMIC CHARACTERISTICS RELATED TO POGO
30 Sep. 1973 160 p refs
(Contract NAS8-27980)
(NASA-CR-144132; RSS-8549-2) Avail: NTIS HC $6.75 CSCL 21H

A linear model of the space shuttle main engine for use in Pogo studies was presented. A digital program is included from which engine transfer functions are determined relative to the engine operating level. Author

N76-15265# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
DESIGN, MANUFACTURE AND QUALIFICATION OF MODULAR POWER CONDITIONING CIRCUITS FOR SPACE APPLICATION USING THICK FILM TECHNOLOGY Final Report
H. Kroeger, J. Spencer, and A. Lewicki Jan. 1975 377 p refs Prepared jointly with Lewicki Microelectronic
(Contract ESTEC-1870/73-HP)
(ESA-CR(P)-719) Avail: NTIS HC $10.75

A study was performed on the use of thick film technology for spacecraft power conditioning circuits. Design rules and guidelines for adapting power conditioning units to thick film technology are outlined. Suitable thick film fabrication processes are selected. A preferred parts list is presented of components suitable to thick film application in space projects. Power chip technology is investigated. Conventional circuits and thick film equivalents are compared. ESA

N76-15266# European Space Agency, Paris (France).
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON THE TRIGGERING AND PROPAGATION OF STEEP-FRONTED PRESSURE WAVES IN LIQUID-PROPELLANT ROCKET ENGINES
Hans G. Ruppik Oct. 1975 166 p refs Transl. into ENGLISH of "Exptl. u. theoretische Untersuch. zur Anfachung u. Ausbreitung steilfrontiger Druckwellen in Fluessigtreibstoff-Raketentriebwerken", DFVLR, Lampoldshausen West Ger. Report DLR-FB-74-67, 4 Oct. 1974 Original German report available from DFVLR, Porz, West Ger. 62.30 DM
(ESA-TT-198; DLR-FB-74-67) Avail: NTIS HC $6.75

The triggering and axial propagation of steep-fronted, high amplitude sawtooth-like wave phenomena was investigated experimentally using a test apparatus consisting of a shock tube and a liquid propellant rocket engine. It was found that in addition to regions of spontaneous occurrence of these waveforms a pulse-sensitive region exists within the considered performance range of the engine using showerhead injection of the liquid hydrogen/liquid oxygen propellant combination. The Lax-Wendroff two-step procedure was applied to solve the system of unsteady conservation equations for the gas phase of the upstream into the combustion gas flow running compression shock. The nearly steady-state conditions in front of the initial shock were established by use of a combustion model which assumes simultaneous evaporation of both propellant components. These conditions were compared with experimental results. The results show the existence of an axial wave throughout the combustion chamber extended propellant conversion zone which also changes considerably the wave parameters of a steep-fronted disturbance of a steady-state. Author (ESA)

N76-15267# Battelle Columbus Labs., Ohio.
DEVELOPMENT AND FABRICATION OF MOTOR CASES UTILIZING TUBE MILL PRODUCTS Final Report, 12 Feb. - 31 Oct. 1974
H. W. Mishler and D. G. Howden Jun. 1975 75 p refs
(Contract DAAH01-84-C-0535; DA Proj. 1M3-62303-A-214)
(AD-A014149; RK-CR-75-28) Avail: NTIS CSCL 21/8

Significant cost savings in the fabrication of small-diameter (less than 12-inch-diameter) solid-propellant, rocket-motor cases can be expected by using commercial tube mill products. This program explored in detail the design and manufacturing parameters for fabricating a conceptual design of motor case using commercial aluminum tube and steel pipe. The parameters examined included availability of material, material properties, size tolerances, fabrication techniques and processes, and fabrication sequence. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-15268* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POLYIMIDES OF ETHER-LINKED ARYL TETRACARBOXYLIC DIANHYDRIDES Patent
James A. Webster, inventor (to NASA) (Monsanto Res. Corp., Dayton, Ohio) Issued 9 Dec. 1975 8 p Filed 11 Jul. 1974 Supersedes N74-29480 (12 - 19, p 2246) Sponsored by NASA
(NASA-Case-MFS-22355-1; US-Patent-3,925,312; US-Patent-Appl-SN-487852; US-Patent-Class-260-47CP; US-Patent-Class-260-32.8N; US-Patent-Class-260-32.6N; US-Patent-Class-260-78TF; US-Patent-Class-260-346.3; US-Patent-Class-260-571) Avail: US Patent Office CSCL 07C

Polyimides comprised of repeating units containing a perfluoralkylene having the structure (CF2n) or a perfluoroalkylene ether having the structure (CF2)m-O-(CF2)m where n is an integer of 2 to 10, and m is an integer of 1 to 10, were found to possess improved thermal, oxidative and hydrolytic stability as well as improved physical and chemical characteristics. These properties make it useful in a variety of applications including that of a sealant in advanced aerospace structures.
Official Gazette of the U.S. Patent Office

N76-15269# Battelle Inst., Frankfurt am Main (West Germany).
STUDY ON POSITIONING AND STIRRING OF MOLTEN MATERIAL IN 'ZERO' GRAVITY ENVIRONMENTS BY ULTRASONIC METHODS
E. G. Lierke Nov. 1974 92 p refs
(Contract ESA-SC/39/40)
(ESA-CR(P)-622) Avail: NTIS HC $5.00

Methods for levitating spherical melts under low gravity conditions were investigated. Basic theoretical and experimental evaluations of acoustic positioning at low ultrasonic frequencies have shown that spherical samples (solid or liquid) can be effectively levitated in standing waves. Multiaxial positioning with standing waves between several radiating transducers is shown to be feasible in a tube when using a combination of a longitudinal plane standing wave and a transverse standing wave described by first order Bessel functions. Contactless stirring of the melt is possible but necessitates prohibitive power density peaks on the sample surface, which are liable to lead to gas bubble generation within the melt. A tube furnace using multiaxial acoustical levitation forces was designed. ESA

N76-15270# Unilever Research, Vlaardingen (Netherlands).
PROSTAGLANDINS AND THE HEART
F. TenHoor and A. J. Vergroesen [1974] 14 p refs Submitted for publication
Avail: NTIS HC $3.50

Relationships between prostaglandins and the heart are discussed. Physiologically active prostaglandins and their essential fatty acid precursors are reviewed. The mechanism of action is discussed and experiments on the effect of prostaglandins on the heart are surveyed. Prostaglandins E(1) and E(2) are involved in the regulation of coronary flow and also play a role in balancing the autonomous nervous control of the heart. PGE(1) and PGF(1 alpha) seem to stimulate the oxygen consumption and the substrate uptake of heart muscle tissue. ESA

N76-15271# Unilever Research, Vlaardingen (Netherlands).
MICROBIOLOGICAL SAFETY AND STABILITY OF FOOD PRODUCTS
G. TuynenburgMuys [1974] 8 p refs Presented at the Symp. on Present Day Status of Microbiol. Monit. of Foods, Rotterdam, 20 Nov. 1974 Submitted for publication
Avail: NTIS HC $3.50

Microbiological control as part of the process control in the food industry, aimed at the limiting of microbial proliferation in food and at the stabilization of packed or canned food of certain categories, is discussed. The microbial stability of eight different classes of stabilized food is dealt with and the death rate of bacteria in the water phase of a margarine water mixture is discussed. ESA

N76-15272# Stanford Univ., Calif. Center for Materials Research.
LONG RANGE MATERIALS RESEARCH Semiannual Technical Report, 1 Jan. - 31 May 1975
Robert A. Huggins Jun. 1975 197 p refs
(Grant DAHC15-73-G15; ARPA Order 2470)
(AD-A014475; SU-CMR-75-13) Avail: NTIS CSCL 20/12

The program is composed of four separate programs as follows: Detection of X-ray radiation; Superplasticity and warm working of metals and alloys; Synthesis of new types of catalyst materials; Development of elevated temperature electrocrystallization techniques. Progress in each of the subareas during this report period is described. GRA

N76-15273# Army Foreign Science and Technology Center, Charlottesville, Va.
NEW INDUSTRIAL MATERIALS
E. I. Belskii, A. M. Dmitrovich, and E. B. Lozhechnikov 1 Apr. 1975 119 p refs Transl. into ENGLISH from the monograph "Novye Materialy v Tekhnike" Minsk, 1971 p 158-233, 266-268
(AD-A014533; FSTC-HT-23-0379-75) Avail: NTIS CSCL 11/6

New materials receiving wide application in industrial production are described. Physical-mechanical and technological properties of polymeric, silicate, metal and mineral ceramics and powder metallurgy parts are given. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N76-15274*# Materials Sciences Corp., Blue Bell, Pa.
FATIGUE OF NOTCHED FIBER COMPOSITE LAMINATES. PART 1: ANALYTICAL MODEL
P. V. McLaughlin, Jr., S. V. Kulkarni, S. N. Huang, and B. Walter Rosen Mar. 1975 117 p refs
(Contract NAS1-12967)
(NASA-CR-132747; MSC/TFR/7501) Avail: NTIS HC $5.50 CSCL 11D

A description is given of a semi-empirical, deterministic analysis for prediction and correlation of fatigue crack growth, residual strength, and fatigue lifetime for fiber composite laminates containing notches (holes). The failure model used for the analysis is based upon composite heterogeneous behavior and experimentally observed failure modes under both static and fatigue loading. The analysis is consistent with the wearout philosophy. Axial cracking and transverse cracking failure modes are treated together in the analysis. Cracking off-axis is handled by making a modification to the axial cracking analysis. The analysis predicts notched laminate failure from unidirectional material fatigue properties using constant strain laminate analysis techniques. For multidirectional laminates, it is necessary to know lamina fatigue behavior under axial normal stress, transverse normal stress and axial shear stress. Examples of the analysis method are given. Author

N76-15275# Texas Univ., Austin. Engineering Mechanics Research Lab.
A STUDY OF WAVE MOTIONS IN FIBER-REINFORCED MEDIUM Interim Report, Sep. 1974 - Jun. 1975
C. H. Yew and P. N. Jogi May 1975 39 p refs
(Grant NSF GK-39921)
(PB-243997/4; EMRL-1114) Avail: NTIS HC $4.00 CSCL 11D

Measurements, both macroscopic and microscopic, of wave motions were made on laboratory fabricated fiber-reinforced composites. Two waves with different speeds and amplitudes were observed. Results are in good agreement with the predictions based on the mixture theory. GRA

N76-15276# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ACCELERATED CHARACTERIZATION OF FIBER/EPOXY COMPOSITES. PART 1: VISCOELASTIC METHODS Final Report, 1 Jul. 1972 - 30 Sep. 1974
Ashok B. Thakker, Halbert F. Brinson, and Robert A. Heller Feb. 1975 169 p refs
(Contract F33615-72-C-2111; AF Proj. 7340)
(AD-A014266; AFML-TR-74-256-Pt-1) Avail: NTIS CSCL 11/4

Time dependent properties of angle ply laminated Boron/Epoxy and Graphite/Epoxy fiber controlled composites were investigated. The main objective of this study was to develop a technique to establish interconversion of different test results using appropriate viscoelastic theory to formulate an accelerated testing procedure. To achieve this aim, forced vibration, constant strain rate and creep tests were performed at different temperature levels. Multiple regression techniques were used to generate response surfaces for significant variables. Master curves using the time-temperature superposition principle were established for individual tests. Mechanical model representation, integral equation formulation and numerical integration methods based on linear viscoelasticity were used to predict constant strain rate and long time creep behavior of composites from nondestructive short time dynamic tests. GRA

N76-15277# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF ENGINEERING DATA ON THE MECHANICAL AND PHYSICAL PROPERTIES OF ADVANCED COMPOSITE MATERIAL Final Report, 1 Jun. 1973 - 31 Jul. 1974
K. E. Hofer, Jr., D. Larsen, and V. E. Humphreys Feb. 1975 201 p refs
(Contract F33615-73-C-5125; AF Proj. 7381)
(AD-A014363; IITRI-D6081-FR; AFML-TR-74-266) Avail: NTIS CSCL 11/4

Data were generated on the effect of various environments on the physical, thermal, and mechanical properties of Thornel 300/Narmco 5208 composites. The laminates were prepared from three-inch wide prepreg tape in accordance with current aerospace specifications. The environments included steady state humidity conditioning for two exposure periods, cyclic humidity conditioning which conductivity, density, steady state thermal exposure, thermo-humidity cycling, intralaminar shear, flex tests, Thornel 300 Graphite/Narmco 5208, graphite/epoxy composites, laminate data, laminate fabrication, moisture weight gain. The mechanical properties investigated included tension, compression, in-plane shear, interlaminar shear and flexural static properties, fatigue, creep and stress-rupture resistances. GRA

N76-15278# Texas A&M Univ., College Station. Mechanics and Materials Research Center.
MACROSCOPIC THEORIES OF CUMULATIVE DAMAGE. 1:

STRAIN FORMATION
G. S. Brockway and G. D. Allen Apr. 1975 51 p refs
(Contract N00014-75-C-0325; NR Proj. 064-520)
(AD-A014610; MM-3168-75-1; TR-1) Avail: NTIS CSCL 11/4

This article is devoted to the formulation of a mechanical constitutive theory accounting for deformation-induced material degradation, such as that resulting from the growth of small flaws. As in a previous investigation by the authors, the degrading material is modeled here as an effectively materially-uniform, simple body in the sense of Noll, 'damage' being interpreted as a permanent alteration in the stress-functional of this effective continuum. The authors' previous theory, which did not account for continued damage at constant strain, is shown here to provide a measure of damage incurred during a given strain history relative to the equilibrium configuration defined by the current value of strain. It is then shown that this 'relative damage functional' can be used to generate an absolute measure of damage if it is accepted that no damage can accrue in the absence of stress. In view of the physical assumptions introduced here, the present formulation appears to encompass fatigue and spallation phenomena as well as the slow deformation of most composite materials. GRA

N76-15279# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FLEXURE FRACTURE OF GRAPHITE-EPOXY Memorandum Report
W. S. DeRosset Jul. 1975 33 p refs
(AD-A014193; BRL-MR-2504) Avail: NTIS CSCL 11/4

Panels of graphite-epoxy composite (Thornel 300 fibers in Fiberite 934 resin) have been statically tested in a flexure device designed to avoid stress concentrations associated with the loading. Measurements were made on the strain to fracture and compared with dynamic test results obtained from work conducted at the Ballistic Research Laboratories Shock Tube Facility. No significant differences in the strain-to-fracture measurements were observed between the static and dynamic tests. Comparison was made with fracture results on Thornel 300 fibers as reported in the open literature, and substantial agreement was found.
Author (GRA)

N76-15280# Army Construction Engineering Research Lab., Champaign, Ill.
RESIN BOUND AGGREGATE MATERIAL SYSTEMS Final Report
D. J. Naus Jul. 1975 23 p refs
(AD-A014141; CERL-TM-M-145) Avail: NTIS CSCL 11/4

Data are presented on composition, strength, modulus of elasticity and thermal expansion for polymer concrete material systems. Resin systems included polyesters, epoxies, and vinyl esters. Fine and coarse aggregate fillers in volume fractions up to 0.85 were incorporated into the resin binders. Fiber reinforcement of various types, lengths, and contents was incorporated into several mixes. By a judicious selection of resin modifiers and filler materials a wide range of densities and strengths may be obtained. Material property data on coefficients of thermal expansion, bond strength, water absorption, and effect of elevated temperatures have been obtained. GRA

N76-15037* Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
POTENTIAL CONTRIBUTION OF HIGH STRENGTH, HIGH MODULUS ARAMID FIBERS TO THE COMMERCIAL FEASIBILITY OF LIGHTER THAN AIR CRAFT
D. L. G. Sturgeon and T. K. Venkatachalam *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 243-255 refs (For availability see N76-15015 06-01) CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N76-15281 Emory Univ., Atlanta, Ga.
SIMPLEX OPTIMIZATION AND EXPERIMENTAL DESIGN IN THE DEVELOPMENT OF ANALYTICAL CHEMICAL METHODS Ph.D. Thesis
Stephen Larry Morgan 1975 363 p
Avail: Univ. Microfilms Order No. 76-1628

The ability of the sequential simplex method (an empirical feedback strategy) to successfully optimize multifactor systems is demonstrated using a manual colorimetric determination of cholesterol in blood serum. A combined absorbance and stability response is maximized as a function of solvent composition, dehydrating reagent concentration, color reagent concentration, and color development time. The simultaneous search for optimum levels of the four factors required only 26 experiments. The optima indicated by the convergence of the simplex algorithm and by derivative plots are confirmed by mapping experiments and regression analysis. The efficiency and simplicity of the experimental designs used are attractive for the development of new analytical methods as well as the improvement of existing ones. Dissert. Abstr.

N76-15282# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
MECHANISTIC STUDIES OF TRIPHENYLPHOSPHINE OXIDE-POLY(ETHYLENETEREPHTHALATE) AND RELATED FLAME RETARDANT SYSTEMS Final Report
J. W. Hastie and C. L. McBee Aug. 1975 46 p
(COM-75-11136/9; NBSIR-75-741) Avail: NTIS HC $4.00 CSCL 21B

A combination of mass spectrometric and optical spectroscopic studies has been made to establish a mechanism for phosphorus controlled flame retardancy in thermoplastics. It is shown that a vapor phase mode of flame inhibition can account for the known flame retardancy effect of triphenylphosphine-oxide in polyester substrates. GRA

N76-15283# California Univ., Santa Barbara. Dept. of Physics.
STUDIES OF SMALL METALLIC PARTICLES FORMED BY HOMOGENOUS NUCLEATION: LIGHT SCATTERING AND ELECTRON MICROSCOPY Final Report, Mar. 1972 - Feb. 1975
Jay D. Eversole, Paul K. Hansma, and H. P. Broida Feb. 1975 48 p refs
(Grant EPA-R-800845)
(PB-244403/2; EPA-650/3-75-006) Avail: NTIS HC $4.00 CSCL 07D

This report describes basic research on the subject of formation and detection of metallic particles ranging from 5 to 5000 nm in diameter. Particulate matter is formed in a flowing inert gas by homogenous nucleation from the vapor phase. Metals used include Na, K, Li, Rb, Cs, Cd, Mg, Zn, and Pb. Particulate matter with diameters less than 100 nm plays an important role in atmospheric pollution, and it is hoped that research will contribute to the detection, measurement, and/or control of this problem. GRA

N76-15284# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW THERMODYNAMIC RELATIONSHIPS AMONG THE PHYSICAL CONSTANTS OF LIQUIDS
V. Popovici 28 Jul. 1975 24 p refs Transl. into ENGLISH from Revue de Physique (Rumania), v. 9, no. 10, 1964 p 963-976
(AD-A014311; FTD-ID(RS)I-1649-75) Avail: NTIS CSCL 07/4

From phenomenological considerations of the structure of liquids, a series of formulas can be obtained which gives quite

satisfactory values of the chief characteristics of normal -- nonassociated -- liquids at some distance from their critical points. It is sufficient to determine the density of a liquid at two different temperatures and to know one other physical constant of the liquid under consideration (for example, the isothermal compressibility or the heat of vaporization) in order to obtain directly eight principal characteristic constants (ten if the molecular weight of the liquid is also known). These characteristics are: the specific volume, coefficient of thermal expansion, isothermal compressibility, internal pressure, difference of heat capacities, internal and total latent heats of vaporization, temperature coefficient of pressure, temperature coefficient of the vapor pressure, and the attraction constant. GRA

N76-15285# Systems Science and Software, La Jolla, Calif.
CAPO EQUATION OF STATE/OPACITY DATA Final Report, 31 Jan. - 31 Jul. 1974
Ira Katz, Robert C. Vik, and James Harvey 18 Jun. 1975 84 p refs
(Contract DNA001-73-C-0061; DNA Proj. NWED-QAXP)
(AD-A014476; SSS-R-74-2417; DNA-3580F) Avail: NTIS CSCL 07/4

Presented here are tables of Equation-of-State and Opacity Data generated by the CAPO EOS/Opacity code. Descriptions of the code and the models employed in it can be found in the references. The tables present CAPO results for a variety of materials which are listed in the Table of Contents. The format is similar to previous summary result tabulations. For each material results are grouped by temperatures. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-15286 Iowa State Univ. of Science and Technology, Ames.
THE THERMAL CONDUCTIVITY OF HIGH PURITY VANADIUM Ph.D. Thesis
Wayne Douglas Jung 1975 109 p
Avail: Univ. Microfilms Order No. 76-1850

The thermal conductivity, Seebeck coefficient, and electrical resistivity of four high purity vanadium samples were measured as functions of temperature over the temperature range 5 K to 300 K. The highest purity sample had a resistance ratio of 1524. The highest purity sample had a thermal conductivity maximum of 920 W/mK at 9 K and had a thermal conductivity of 35 W/mK at room temperature. At low temperatures, the thermal resistivity was limited by the scattering of electrons by impurities and phonons. The thermal resistivity of vanadium departed from Matthiessen's rule at low temperatures. The electrical resistivity and Seebeck coefficient of high purity vanadium showed no anomalous behavior above 130 K. The intrinsic electrical resistivity at low temperatures was due primarily to interband scattering of electrons. The Seebeck coefficient was positive from 10 K to 240 K and had a maximum which was dependent upon sample purity. Dissert. Abstr.

N76-15287 Connecticut Univ., Storrs.
LATTICE THERMAL CONDUCTIVITY OF DEFORMED AND ANNEALED ALUMINUM ALLOYS AT LOW TEMPERATURES Ph.D. Thesis
Nagavarapu Surya Mohan 1975 172 p
Avail: Univ. Microfilms Order No. 76-1692

The electrical and thermal conductivities of a number of aluminum-magnesium and a few commercial aluminum alloys samples with magnesium concentrations varying from 2.7 at.% to 10 at.%, were measured in the temperature range 1.3-60 K, in various deformed and heat treated conditions. The thermal conductivity data was used to obtain the lattice thermal conductivity. The lattice thermal conductivity of these alloys exhibits a T square dependence at temperatures up to about 15 K characteristic of scattering of phonons by electrons and sessile dislocations. The lattice thermal conductivity goes through a maximum at approximately 40 K due to the increasing importance of umklapp processes. Theoretical fits to the lattice thermal conductivity of well annealed samples were obtained by varying the parameters representing electron-phonon, point defect and umklapp scattering strengths. This analysis was extended for the partially annealed and deformed samples to obtain the dislocation lattice thermal resistivity. Author

N76-15288 Pittsburgh Univ., Pa.
THE MECHANICAL PROPERTIES OF LOW TEMPERATURE PROTON IRRADIATED SINGLE CRYSTAL COPPER Ph.D. Thesis
Michael Schildcrout 1975 105 p
Avail: Univ. Microfilms Order No. 76-372

Single crystal copper samples, of varying degrees of cold work, were irradiated near either liquid helium or liquid nitrogen temperature by 10.1 MeV protons. The internal friction and dynamic Young's Modulus were observed as a function of either temperature or integrated proton flux. The primary effect of irradiation was to produce dislocation pinning. The bulk effect was observed after dislocation pinning was completed. Expressed in terms of the fractional change in Young's modulus per unit concentration of irradiation induced defects, it was measured at liquid helium temperature to be -18.5 + or - 3. An anelastic process occurring near 10 K for low kHz frequencies and due to stress-induced ordering of point defects produced by irradiation was also studied. Previous conclusions on its orientational dependence were confirmed. In addition, the peak height per unit fluence was found to decrease with increasing cold work. The peak was not observed in samples compressed 25%. Dissert. Abstr.

N76-15289 Northwestern Univ., Evanston, Ill.
FATIQUE STUDIES ON 4140 QUENCHED AND TEMPERED STEEL Ph.D. Thesis
Paul Nicolas Thielen 1975 145 p
Avail: Univ. Microfilms Order No. 75-29770

The low cycle fatigue and the fatigue crack propagation behavior of 4140 steel were investigated as functions of the tempering temperature. Crack propagation results obtained on center notched specimens were in good agreement with those obtained on single edge notched specimens. Single edge notched specimens tempered at high temperatures showed, however, a very significant transient delay in the crack growth right after nucleation. This effect was attributed to the compressive stresses generated around the initial notch during the crack nucleation stage. The experimental results were compared to the predictions of a number of recent crack propagation laws. An equation suggested by Rosenfield and McEvily predicted well the observed increase of the stress intensity exponent in the Paris equation with decreasing fracture toughness, the upper instability in the crack propagation and the effect of the mean stress. Dissert. Abstr.

N76-15290 Purdue Univ., Lafayette, Ind.
MULTIPHASE DIFFUSION IN TERNARY ALLOYS Ph.D. Thesis
Richard Dean Sisson, Jr. 1975 219 p
Avail: Univ. Microfilms Order No. 76-591

Interdiffusion between the alpha and beta phases of the Cu-Ni-Zn system at 775 C was investigated with solid-solid type diffusion couples for the development of both planar and nonplanar interfaces. The velocity of the alpha/beta interface, phi 1 was experimentally measured and also calculated based on a simple flux balance of the components at the interface. Good agreement was observed among the experimental values and calculated values of phi 1 for couples with planar interfaces. There appeared to be a disagreement in sign of phi 1 in calculated values based on Ni for couples with nonplanar interfaces. The shape transition of an initially planar alpha/beta interface morphology was studied with series of couples characterized by a gradual change in one of the terminal compositions. It was observed that in couples with a planar interface the concentration of the components at the alpha/beta interface were in agreement with predictions based on equilibrium tie-line measurements. Dissert. Abstr.

N76-15291*# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Mechanical Engineering.
A FINITE ELEMENT FORMULATION FOR EVALUATION OF CRACK BLUNTING EFFECTS IN ELASTO-PLASTIC SOLIDS

J. R. Osias 10 Nov. 1975 20 p refs
(Grant NGR-39-087-053)
(NASA-CR-146070; SM-75-7) Avail: NTIS HC $3.50 CSCL 11F

The sharp crack model allows the use of continuum analysis, linear elasticity, as a basic for predicting a mircomechanical process, fracture, by providing a characterization of loading conditions affecting a very small volume of material. The model is described in detail. Author

N76-15292# New England Inst. for Medical Research, Ridgefield, Conn.
DETECTION OF VACANCY CONCENTRATION AND DEFECTS IN ALUMINUM, TITANIUM AND THEIR ALLOYS AND NICKEL BASE SUPERALLOYS BY POSITRON ANNIHILATION Final Report, Dec. 1973 - Nov. 1974
Shu-Jen Tao Mar. 1975 54 p refs
(Contract N00019-74-C-0170)
(AD-A011368) Avail: NTIS CSCL 11/6

Positron annihilation has been used as a tool to study the effects of defects in crystalline solids in the realm of fundamental research for a long time. This paper reports an initial effort to evaluate the usefulness and the future development of positron annihilation as a tool in nondestructive evaluation, NDE. The metals studied included Al (99.99%), Al-1100, Al-2024, Ti-35A, Ti-6Al-4V, and nickel based superalloys, U-700 and M-200. The processes studied involve temperature change, work-hardening, stress-strain, creep and cyclic fatigue. The conclusion is that the process of positron annihilation is very sensitive to many kinds of defects in metals and that its potential as a tool of NDE is high. Certainly, more work is required to explore its full potential. A brief review describing the method of positron annihilation and its interaction with defects in metals is attached as an appendix. GRA

N76-15293# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ABNORMAL CREEP OF TITANIUM DURING THE ALPHA, BETA ALLOTROPIC TRANSFORMATION Ph.D. Thesis - Paris Univ.
Catherine Chaix Jul. 1975 40 p refs In FRENCH; ENGLISH summary Report will also be announced as translation
(ONERA-NT-1975-1) Avail: NTIS HC $4.00

Compression tests of anisothermal creep, performed on titanium specimens of current purity, show that this material is subjected to an abnormal contraction during its alpha, beta change of phase. The amplitude of this deformation is proportional to the applied stress, and independent from temperature variation rate. Optical microscope observations in polarized light reveal the texture of the specimens deformed under stress. Three types of interpretation may be suggested to attempt to explain this experimental phenomenon. The first one is connected with titanium crystallography; the second assumption rests on a modification of the dislocations rise conditions; lastly, according to the third assumption, abnormal plasticity is due to the volume variation accompanying the phase change. It is shown that only the last of these interpretations can account quantitatively for the abnormal contraction observed during mechanical tests. Author (ESA)

N76-15294# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
HYDROGEN ASSISTED FATIGUE CRACKING OF HIGH STRENGTH ALUMINUM ALLOYS
E. F. Smith, III, R. Jacko, and D. J. Duquette Aug. 1975 27 p refs
(Contracts N00014-67-A-0117-0012; N00014-75-C-0466; NR Proj. 036-093)
(AD-A014477) Avail: NTIS CSCL 11/6

High cycle tension-tension fatigue tests have been performed on a 7075-T6 alloy in air, in 0.5N NaCl, pre-corroded in 0.5N NaCl, re-heat-treated and tested in air. Additionally fatigue tests were performed on a high purity analogue alloy, (Al-5.5Zn 2.5Mg-1.5Cu) in air, in 0.5N NaCl and in NaCl with applied cathodic currents (hydrogen charged). Corrosion fatigue of the high-purity alloy resulted in intergranular crack initiation with a shift to transgranular cracking as the crack propagated. High charging currents and high cyclic stresses tended to reduce the relative amount of intergranular cracking. Transgranular fatigue fracture surfaces differed from those observed in air tests in that they were highly faceted (crystallographic) and exhibited cleavage-type markings. These results indicate that corrosion fatigue of high-strength aluminum alloys is a hydrogen embrittlement process with hydrogen being produced by corrosion of the alloy. Transgranular cracking occurs when high cyclic stresses induce mobile dislocations which cause hydrogen migration into the grains in fatigue-generated slip bands. GRA

N76-15295# Army Foreign Science and Technology Center, Charlottesville, Va.
PRACTICAL UTILIZATION OF CARBONYLS AND THEIR COORDINATION COMPOUNDS
N. A. Belozerskii and O. D. Krichevskaya 10 Sep. 1975 15 p refs Transl. into ENGLISH from Probl. Sovrem. Khimii Koordinatsionnykh Soedin. (USSR), no. 3, 1970 p 246-255
(AD-A014528; FSTC-HT-23-1145-75) Avail: NTIS CSCL 07/2

The chemistry of metal carbonyls was discussed. GRA

N76-15296# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
CATALYSTS GENERATED BY PHOTOLYSIS OF COORDINATION COMPOUNDS Technical Report, 1 May 1974 - 30 Apr. 1975
Mark S. Wrighton 3 Jul. 1975 21 p refs
(Contract N00014-67-A-0204-0088; NR Proj. 051-579)
(AD-A014577; TR-1) Avail: NTIS CSCL 07/5

Chromium carbonyl photocatalyzed hydrosilation of dienes, Mo(CO)6 photoassisted decomposition of t-BuOOH, Fe(CO)5 photocatalyzed reactions of alkenes, and initial experiments with M3(CO)12 (M = Fe, Ru, Os) and multiple metal-metal bonds are summarized. Author (GRA)

N76-15297# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
PENTACARBONYLIRON (0) PHOTOCATALYZED HYDROGENATION AND ISOMERIZATION OF OLEFINS
Mark A. Schroeder and Mark S. Wrighton 3 Jul. 1975 43 p refs
(Contract N00014-67-A-0204-0088; NR Proj. 051-579)
(AD-A014578; TR-5) Avail: NTIS CSCL 07/5

Mechanistic studies of Fe(CO)5 photocatalyzed alkene isomerization are reported along with characterization of the photocatalyzed hydrogenation of olefins under mild conditions using Fe(CO)5 as the photocatalyst. The key repeating unit is shown to be a Fe(CO)3 species. GRA

N76-15298# Illinois State Water Survey, Urbana.
CORROSION BY DOMESTIC WATERS
T. E. Larson 1975 53 p refs
(PB-244723/3; ISWS-75-BULL-59; W75-11062) Avail: NTIS HC $4.50 CSCL 11F

Domestic water was defined as any water provided for human consumption and allied uses, in contrast to sea water, brines, or conventional sewage effluents. A brief review of basic fundamentals of corrosion is presented. Also included were some of the general and specific recommendations concerning inhibitors and construction materials that were developed through laboratory and field evaluations. Appendixes contain: (1) a discussion of corrosion in water wells and pumps; (2) a description of the dynamic nature of distribution systems and the problems that can exist; and (3) documentation of actual changes in water quality resulting from microbiological growths to the point of removal of all oxygen and further changes under anaerobic conditions in a 6500-foot isolated water line at the end of the system. GRA

N76-15299# Bureau of Mines, Rolla, Mo. Rolla Metallurgy Research Center.
COMPOSITION OF LEAD SINTER
W. M. Dressel, P. G. Barnard, and W. C. Clinton Jul. 1975 40 p refs
(PB-244372/9; BM-RI-8059) Avail: NTIS HC $4.00 CSCL 11F

Microscopic and electroprobe studies of lead sinters and

roasted mixtures of lead sulfide with varying amounts of SiO2 CaO, Fe2O3, and ZnS are presented. The studies show that lead silicates, lead-zinc silicate, calcium-zinc silicate, and spinels or ferrite are the principal constituents of sinters with lead oxide and lead sulfides only occurring as a result of nonhomogeneous mixing of materials prior to sintering. The study gives an insight into the process and shows that sintering results from a complex interaction of all the constituents of the sinter and that the nonlead-bearing compounds added to sinter mixes do not simply dilute the mixture to control the rate of oxidation of lead sulfide. A review of the literature relating to reaction of lead with sulfur, oxygen, and silica is given. GRA

N76-15300# Washington Univ., Seattle. Dept. of Mechanical Engineering.

A DYNAMIC PHOTOELASTIC ANALYSIS OF CRACK BRANCHING

A. S. Kobayashi, S. Mall, and W. B. Bradley (Shell Develop. Co.) Jul. 1975 25 p refs Presented at the 1975 Ann. Meeting of the Soc. for Eng. Sci., Austin, Tex., 20-22 Oct. 1975

(Contract N00014-67-A-0103-0040)

(AD-A014479; TR-22) Avail: NTIS CSCL 11/6

Previous dynamic photoelastic data on crack branching in edge-cracked Homalite-100 tension specimens were re-evaluated using the concept of averaged dynamic strain energy release rate. Dynamic stress intensity factors, K sub D, which were determined by dynamic photoelasticity, were used to compute the dynamic strain energy release rates G sub D. Average strain energy release rates, G sub D ave, were then obtained by dividing sums of the total dynamic strain energies released by the corresponding total surface areas of newly generated crack surfaces. This new evaluation of previous data indicates that crack branching occurred when G sub D ave = 2 G sub C where G sub C is the critical static strain energy release rate of the Homalite-100 sheets used in this investigation. GRA

N76-15301# Texas A&M Univ., College Station. Engineering Experiment Station.

THE OFFICE OF NAVAL RESEARCH PLASTICITY WORKSHOP

Kenneth J. Saczalski, ed. (ONR) and James A. Stricklin, ed. Jun. 1975 211 p refs Workshop held at College Station, Tex., 3-5 Oct. 1974 Sponsored by ONR

(AD-A014484; TEES-RPT-75-51) Avail: NTIS CSCL 11/6

Contents: An experimental study of yield surfaces in a combined axial-torsional space for type 304 stainless steel; A comparison of the capability of four hardening rules to predict a material's plastic behavior; Abstract from Pressure dependence of yielding and associated volume expansion in tempered martensite; A review of some piecewise linear theories of plastic strain hardening; Plasticity in engineering analysis; Plasticity in finite element methods; Some features of plasticity constitutive relations as inferred from microscale models of metal deformation; A practical two surface plasticity theory; Experimental observations on aluminum and copper subjected to biaxial loading; Inelastic analysis in the creep range. GRA

N76-15302# Johns Hopkins Univ., Baltimore, Md.

A NEW, GENERAL THEORY OF PLASTICITY FOR STRUCTURAL METAL ALLOYS Final Report, 14 Oct. 1969 - 17 Jul. 1974

James F. Bell Jul. 1975 118 p refs

(Contract DAAD05-70-C-0054; DA Proj. 1T1-61102-A-33E)

(AD-A014192; BRL-CR-250) Avail: NTIS CSCL 11/6

A new, general theory of plasticity for structural metal alloys of steel, aluminum, and copper is presented. Based on experiment, general constitutive equations are provided in the two-dimensional domain for any arbitrary loading path, whether proportional or non-proportional. Two regions of large deformation have been found, an intermediate elastic-plastic region and a totally plastic region, the former bounded by an inner and outer yield surface. The functional relation between the generalized stress and strain is parabolic, with detailed constitutive relations given for each region of deformation. A new phenomenon of 'eruptive' plastic deformation has been found when impact velocities are sufficiently high for the strain to reach the outer yield surface bounding the regions of plasticity. At this critical velocity the maximum strain increases from three to eight times, depending on the alloy, over that immediately below the critical value. GRA

N76-15303# Frankford Arsenal, Philadelphia, Pa.

BINARY PROJECTILE CORROSION PROBLEM, CORROSION AND CORROSION INHIBITION OF METALS IN HYDROFLUORIC ACID SOLUTION

Fred Pearlstein and Robert F. Weightman Apr. 1975 24 p refs

(DA Proj. 1T1-611101-A-9A)

(AD-A014163; FA-TR-75025) Avail: NTIS CSCL 11/6

Corrosion inhibition studies were conducted in relation to a problem encountered with a binary projectile system. It was found that corrosion of steel in dilute (0.59 N) hydrofluoric acid solution was greatly retarded by the addition of small amounts of As2O3, o-tolylthiourea (OTTU), benzotriazole (BT), gelatine (GEL), quinoline ethiodide (QEI), or n-laurylpyridinium chloride (NLPC). The combination of OTTU-BT provided quite effective inhibition with little tendency for pitting corrosion. The addition of inhibitor to hydrofluoric acid solution resulted in an increase in the corrosion potential of steel indicative of predominant inhibition of the anodic reaction. The highest potential was obtained with OTTU addition. The ability for various metals to resist hydrofluoric acid attack was determined in order to arrive at potential coating systems for steel or alternate membrane materials. Corrosion inhibitors in the actual corrosive agent of the binary projectile were relatively ineffective for reducing corrosion rates of steel. GRA

N76-15304# General Dynamics/Fort Worth, Tex.

NONDESTRUCTIVE TESTING OF DIFFUSION BONDED TITANIUM ALLOYS FOR ENGINE AND AIRFRAME COMPONENTS Final Report, 30 Jun. 1972 - 30 Jun. 1974

John A. Regalbuto, D. E. Gordon, B. O. McCauley, J. S. Kunselman, and R. H. McDaniel May 1975 386 p refs

(Contract F33615-72-C-1705; AF Proj. 7351)

(AD-A014361; AFML-TR-74-215) Avail: NTIS CSCL 11/6

The development and evaluation of ultrasonic instrumentation for the nondestructive testing of diffusion bonded titanium alloy components is described. Results of a survey to define potential diffusion bonding deficiencies are given. A signal-averaging pulse-echo system developed to increase defect signal-to-grain noise ratio is described. The AFML Computer-Automated Ultrasonic Inspection System was used to evaluate displaced and angularized bond planes. Diffusion bonded internal defect specimens were evaluated by blue-etch-anodize, fluorescent penetrant, signal-averaged pulse-echo, and Delta-Scan techniques. Ultrasonic attenuation measurements versus grain size are reported. Static tensile and axial fatigue data are reported and correlated with nondestructive evaluation and fractographic results. Acoustic emission behavior of parent material specimens is compared with that of internal defect specimens. GRA

N76-15305# Dayton Univ. Research Inst., Ohio.

STATIC AND DYNAMIC FRACTURE PROPERTIES FOR ALUMINUM ALLOY 7475-T651 AND T7351 Final Report, Oct. 1973 - Dec. 1974

R. R. Cervay Apr. 1975 38 p refs

(Contract F33615-74-C-5024; AF Proj. 7381)

(AD-A014353; AFML-TR-75-20) Avail: NTIS CSCL 11/6

A broad base of mechanical property data were developed on two plates of Al 7475. One of the 1-1/2-inch thick plates was in the T7351 condition and one was in the T651 condition. The tensile properties of the T651 plate were higher than those of the T7351 plate. Nearly all of the fracture toughness tests were invalid by ASTM test standards; those that were valid indicate the material possesses good toughness. The conditional toughness values (K sub Q) for identical test conditions indicate the T7351 processing possesses the superior toughness property. The smooth and notched fatigue properties were about equal to those of other 7000-series aluminum alloys. Constant amplitude fatigue crack growth resistance was better than some older 7000-series alloys and similar to other new 7000-series alloys while the stress corrosion cracking properties in a salt water environment were excellent. Most of the tests were repeated using specimens that had been subjected to 250 F (121 C) for 1000 hours. This time-temperature exposure resulted in: (1) a slight reduction in tensile strength, (2) a slight increase in

conditional toughness (K sub Q) for the T651 plate and a small decrease in K sub Q for the T7351 heat treated plate, (3) a slight reduction in fatigue properties, and (4) negligible effect on the fatigue crack growth rate and corrosion properties.
Author (GRA)

N76-15306# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A PRELIMINARY STUDY OF FATIGUE CRACK RETARDATION USING LASER INTERFEROMETRY TO MEASURE CRACK SURFACE DISPLACEMENTS Technical Report, Jan.-Aug. 1974
W. N. Sharpe, Jr. and A. F. Grandt, Jr. Mar. 1975 39 p refs Presented at Natl. Symp. on Fracture Mechanics (18th), Brown Univ., Providence, 26-28 Aug. 1974
(AF Proj. 7351)
(AD-A014342; AFML-TR-74-203) Avail: NTIS CSCL 11/6

A laser interferometry technique is described which is capable of resolving crack surface displacements to a high degree of sensitivity (about 0.1 micron). The method provides continuous measurements of the free surface crack profile in metal specimens without being limited by rigid body displacements. Using the laser interferometry procedure to determine fatigue crack profiles in 2024-T851 aluminum specimens, it was possible to measure the load at which the crack faces completely separate. These opening loads were correlated with peak tensile overloads and subsequent crack retardation. These results are discussed in terms of the Elber concept of fatigue crack closure. Author (GRA)

N76-15307# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
MICROSTRUCTURE AND HIGH TEMPERATURE PROPERTIES Final Report, Nov. 1970 - Nov. 1974
James A. Roberson, A. M. Adair, and Harry A. Lipsitt Jun. 1975 6 p
(AF Proj. 7021)
(AD-A014241; ARL-75-0135) Avail: NTIS CSCL 11/6

This investigation centered on three topics: the hot working of Ti-6Al-2Sn-4Zr-2Mo to determine the microstructure-processing history relationship; to determine the relationship of service properties to the above, and to study the powder processing of a typical titanium alloy, Ti-6Al-6V-2Sn. The results of the program have been presented in a series of papers published in the literature. Author (GRA)

N76-15308# Martin Marietta Labs., Baltimore, Md.
THE INFLUENCE OF LOADING MODE ON THE STRESS CORROSION SUSCEPTIBILITY OF VARIOUS ALLOY/ENVIRONMENT SYSTEMS Interim Technical Report
J. A. S. Green, H. W. Hayden, and W. G. Montague Aug. 1975 35 p refs
(Contract N00014-74-C-0277; NR Proj. 031-716)
(AD-A014611; MML-TR-75-30C) Avail: NTIS CSCL 11/6

The influence of loading mode on stress-corrosion susceptibility has been examined for the following systems: Ti- 8Al 1Mo 1V alloy/aqueous chlorides; alpha - brass/ammoniacal environments, 7075-T6 Al alloy in NaCl/K2Cr2O7 solutions. With the exception of the alpha- brass/ammonia system, the stress-corrosion susceptibility of the metals was found to be much greater under tensile (mode I) loading than torsional (mode III) loading. Further, in certain instances the addition of hydrogen-recombination (cathodic) poisons, i.e., arsenic, was found to enhance susceptibility to cracking as a function of loading mode is interpreted to indicate that hydrogen damage is the dominant mechanism leading to failure. Implications of these results to mechanistic understanding are discussed. GRA

N76-15309# Naval Civil Engineering Lab., Port Hueneme, Calif.
METAL HYDRIDES FOR ENERGY STORAGE APPLICATIONS Technical Note, 1 Jul. 1973 - 30 Jun. 1974
S. C. Garg and A. W. McClaine Jun. 1975 60 p refs
(AD-A014174; CEL-TN-1393) Avail: NTIS CSCL 07/2

A survey was made of metal hydrides for energy storage in the form of hydrogen, heat, and a combination of both. Five intermetallic compounds were found to be promising energy storage vehicles. They were: MgNi, FeTi, LaNi5, La(0.3)Ni5, and Mischmetal Ni5. The most important property common to all these hydrides is their ability to store large quantities of hydrogen per cubic foot of the hydride: between 5 and 7 pounds per cubic foot, compared to a liquid hydrogen density of about 4.4 pounds per cubic foot. Each of these compounds was found to be able to store hydrogen under different experimental conditions, and each has its unique properties and handling characteristics. The survey was followed by a consideration of areas of possible useful applications. Several areas where metal hydrides can be of use are discussed in detail, including energy storage at remote bases and combat zones, underwater fuel storage, fuel and heat storage in closed system operations, and their use in heat pumps and automotive applications. Because of the ability of metal hydrides to supply hydrogen and absorb exhaust heat at the same time, and to deliver this absorbed heat during recharging where it can be used, they are useful in achieving better utilization of available energy. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-15310* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIBER MODIFIED POLYURETHANE FOAM FOR BALLISTIC PROTECTION Patent
Richard H. Fish, John A. Parker, and Robert W. Rosser, inventors (to NASA) Issued 28 Oct. 1975 6 p Filed 19 Sep. 1973 Supersedes N74-11366 (12 - 02, p 0182)
(NASA-Case-ARC-10714-1; US-Patent-3,916,060; US-Patent-Appl-SN-398885; US-Patent-Class-428-303; US-Patent-Class-260-2.5AK; US-Patent-Class-427-196; US-Patent-Class-427-426) Avail: US Patent Office CSCL 11G

The patent of an invention dealing with a fiber modified polyurethane foam for ballistic protection was presented. The substance consists of a closed cell, semi-rigid, fiber-loaded, self-extinguishing ballistic resistant foam. It has the properties of retarding penetration of incendiary ballistics, prevention of fire in the void spaces of an aircraft, providing support for the fuel cell and strengthening the airframe. The strength of the foam is enhanced by the fibers being oriented parallel to the surface of the substrate on which the foam is sprayed. The fibers should preferably be made of glass, and other materials may be added such as fire-retardant materials. Details of the chemical composition are given. Y.J.A.

N76-15311* National Aeronautics and Space Administration. Pasadena Office, Calif.
CERMET COMPOSITION AND METHOD OF FABRICATION Patent
Wayne M. Phillips, inventor (to NASA) (JPL) Issued 16 Dec. 1975 10 p Filed 5 Apr. 1973 Supersedes N73-23629 (11 - 14, p 1679) Sponsored by NASA
(NASA-Case-NPO-13120-1; US-Patent-3,926,567; US-Patent-Appl-SN-348422; US-Patent-Class-29-182.5) Avail: US Patent Office CSCL 11B

A process for producing a cermet composition applicable as electrical insulator seals for thermionic diodes is described. Particles of a high temperature resistant metal or metal alloy are mixed with a ceramic oxide powder and vacuum sealed and sintered under high pressure in a high temperature autoclave operation. Official Gazette of the U.S. Patent Office

N76-15312 Catholic Univ. of America, Washington, D.C.
THE THERMODYNAMICS AND KINETICS OF PHASE DECOMPOSITION IN THE SECOND ORDER PHASE TRANSITION OF A BOROSILICATE GLASS Ph.D. Thesis
Jose Mauro Leal Costa 1975 169 p
Avail: Univ. Microfilms Order No. 76-1179

The kinetics and thermodynamics of phase-separation in an alkali-borosilicate glass forming liquid were studied. The coexistence temperature and the compositions of the equilibrium phases as a function of temperature were determined. The data were fitted to a modified regular solution theory expression for the

coexistence curve. The glass was treated as a pseudo-binary solution. The kinetics of phase-separation was studied by measuring the specific heat at constant pressure of phase-separated glass samples as a function of temperature during rate heating experiments. The enthalpies due to dissolution of the phases were measured and the relaxation times for compositional changes were calculated using a relaxation model for the enthalpy. This model also permitted evaluation of characteristic microstructure sizes of the phases during the early stages of phase-separation. It was verified that the growth of the microstructure at the late stages of phase-separation followed a coarsening law. Dissert. Abstr.

N76-15313*# General Dynamics/Convair, San Diego, Calif.
DESIGN AND DEVELOPMENT OF POLYPHENYLENE OXIDE FOAM AS A REUSABLE INTERNAL INSULATION FOR LH2 TANKS Final Report, Jul. 1971 - Jun. 1975
Jun. 1975 211 p refs
(Contract NAS8-27566)
(NASA-CR-144071; CASD-NAS-75-020) Avail: NTIS HC $7.75 CSCL 11G

Material specification and fabrication process procedures for foam production are presented. The properties of mechanical strength, modulus of elasticity, density and thermal conductivity were measured and related to foam quality. Properties unique to the foam such as a gas layer insulation, density gradient parallel to the fiber direction, and gas flow conductance in both directions were correlated with foam quality. Inspection and quality control tests procedures are outlined and photographs of test equipment and test specimens are shown. Author

N76-15314*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CERAMIC FIBER INSULATING MATERIAL AND METHODS OF PRODUCING SAME Patent Application
Rueby Y. Lin (Carborundum Co.) and Edward A. Struzik, inventor (to NASA) (Carborundum Co.) Filed 15 Dec. 1975 29 p
(Contract NAS9-13641)
(NASA-Case-MSC-14795-1; US-Patent-Appl-SN-640806) Avail: NTIS HC $4.00 CSCL 11B

A method is presented of producing heat resistant, light-weight insulating nonporous foams by admixing insulating fibers such as alumina-silica fibers, phenol-formaldehyde fibers, glass fibers, or mixtures thereof with a surface active agent and soluble organic resinous binder. The mixture is then agitated to produce a stable homogenous foam. Then the foam is dewatered. The dewatered foam is heat treated to produce a dry porous, nonfluid foam. NASA

N76-15315# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDIES OF THE HIGH-TEMPERATURE BEHAVIOR OF ZIRCON
S. B. Hanna 19 Jun. 1975 17 p refs Transl. into ENGLISH from Silikat Tech. (East Berlin), v. 24, no. 8/9, 1973 p 309-312
(AD-A014307; FTD-ID(RS)I-1544-75) Avail: NTIS CSCL 08/7

It was the aim of this work to shed more light on the interactions between the cleavability of zircon and its dissociation depending on temperature, holding time, quantity of impurities and the particle size of the material. GRA

N76-15316# Army Materials and Mechanics Research Center, Watertown, Mass.
ASSESSMENT OF STRENGTH-PROBABILITY-TIME RELATIONSHIPS IN CERAMICS Technical Report, 1 Jun. 1974 - 30 Jun. 1975
Edward M. Lenoe and Donald M. Neal Jun. 1975 29 p refs (ARPA Order 2181)
(AD-A014153; AMMRC-TR-75-13) Avail: NTIS CSCL 11/2

In the past few years a number of test procedures have evolved as a result of attempts to observe stable crack growth in ceramics under constant stress conditions. These procedures are briefly reviewed. The available slow crack growth data which has been presented in the literature is used to estimate survival times for various stress levels. The computations are completed in several ways: (a) use of strength data obtained at various loading rates; (b) deterministic integration of the equations; and (c) in a Monte Carlo sense, wherein the controlling parameters are assumed to possess realistic variability. The end product of each set of computations is a design stress-survival time relationship and the purpose of this paper is to compare these life estimates and comment on the adequacy of each method. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-15317# Naval Surface Weapons Center, White Oak, Md.
AN ANALYSIS OF SMALL SCALE GAP TEST SENSITIVITY DATA USING POROSITY THEORY AND NONREACTIVE SHOCK HUGONIOTS
R. J. Bauer 20 Jun. 1975 23 p refs
(AD-A014212; NSWC/WOL/TR-75-67) Avail: NTIS CSCL 19/1

An analysis was performed of Small Gap Test (SSGT) sensitivity data using nonreactive shock Hugoniots, and a recently developed concept which relates sensitivity to porosity. The basic idea of the concept is that detonation is achieved, regardless of porosity, when a critical thermal energy is induced into the explosive by shock. This analysis supports the validity of this notion, both for TATB-like explosives, for which it was conceived, and for other explosive materials as well. GRA

N76-15318# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AGM-69A SRAM EXPLOSIVE COMPONENTS SURVEILLANCE PROGRAM SUMMARY REPORT AND FY74 SERVICE LIFE ESTIMATE, VOLUME 1
Charles E. Stanbery and Lester L. Lyles Jan. 1975 93 p refs (Contracts F33657-71-C-0918; F33657-73-C-0734)
(AD-A014428; ASD-TR-75-4-Vol-1) Avail: NTIS CSCL 21/8

Service life estimates for the SRAM rocket motor and ordnance devices are contained in this document. Results of the initial survey are scheduled for publication in Fiscal Year 1974, and annually thereafter. The purpose of this document is to present the life expectancy of components to allow orderly replacement of aged-out components with minimum impact on weapon system operational capability and give a overall surveillance program summary report thru November 1974. This report consists of two Volumes. Volume I contains the SRAM Surveillance Program Summary Report and the FY74 SRAM Service Life Estimate. Volume 2 consists of three appendices on the SRAM Service Life estimate procedures, Rocket Motor and explosive components. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-15319 Polish Academy of Sciences, Warsaw.
SIMULTANEOUS BENDING AND TENSION OF A FLAT, REINFORCED RUBBER BELT WITH UNSTRETCHED CORD IN THE NONLINEAR ASPECT OF THE THEORY OF ELASTICITY [JEDNOCZESNE ZGINANIE I ROZCIAGANIE]
M. Dudziak and J. Mielniczuk 4 Jun. 1975 17 p refs In POLISH
Avail: Issuing Activity

The dimensions of the belt are discussed along with the stress distribution in various components of the belt. Theoretical solutions are verified using numerical methods, and influence of the loading on the stress distribution is considered.

Transl. by M.J.S.

N76-15320# Naval Civil Engineering Lab., Port Hueneme, Calif. Naval Construction Battalion Center.

GUIDELINE SYSTEMS FOR DEEP-SEA DEPLOYMENTS Final Report, Jul. 1972 - Oct. 1973

Francis C. Liu Dec. 1974 38 p refs

(yf53535004)

(AD-A004931; CEL-TN-1365) Avail: NTIS CSCL 13/10

A mechanical cable is stretched between the surface and the seafloor to serve as a guideline for directing a suspended payload to a seafloor site. There were two series of sea tests conducted: one at the 600-foot depth, and the other at 4500. The results show that, after the lift line and the guideline are sufficiently uncoupled from surface excitation, single and double guideline systems can be operated in water depths to at least 4500 feet without serious entanglement. Payload rotation produced during the deployment test was found to be small, and results from variations in static forces. The design of guideline hardware, and at-sea handling is discussed. It is recommended that in addition to surface motion compensation, a means for releasing in-line torque must be provided to achieve entanglement-free operations. GRA

N76-15321# Mar, Inc., Rockville, Md.

A CONCEPTUAL STUDY OF THE FACTORS INVOLVED IN INSTALLATION, OPERATION, AND RECOVERY OF MOORS WITH ATTACHED BOTTOM-MOUNTED SENSORS Final Report

Shelton M. Gay, Jr. Jul. 1975 98 p refs

(Contract N00014-74-C-0310; NR Proj. 294-032)

(AD-A013603; MAI-05-75-001) Avail: NTIS CSCL 13/10

A conceptual study is reported of potential failure mechanisms associated with installation, operation and recovery of deep-sea buoy moors with attached bottom-mounted sensors. The study is directed to the 'anchor-last' mode of installation. The effects considered include, among others, initial launch geometry, stability characteristics of the components (including torsional characteristics of the cables, both internally and externally generated), relation of the outlying instrument leads to the mooring riser, spin-stability of objects suspended by multiple lines and hydrodynamic effects such as strum and component rotation. The length of the instrument leads in relation to the depth is identified as an important parameter. The utility of modeling and the status of algorithms useful in the design of deep-sea mooring installations are discussed. A general installation procedure is suggested. GRA

N76-15322# Naval Ship Research and Development Center, Bethesda, Md.

INCIPIENT CAVITATION RESULTS ON 16-012 AND 16-(0.15)12 HYDROFOILS IN 24- AND 36-INCH WATER TUNNELS Final Report

Douglas E. Layne Feb. 1975 59 p refs

(AD-A005366; NSRDC-4578) Avail: NTIS CSCL 13/10

Cavitation inception data were obtained in the Center's 24- and 36-inch variable-pressure water tunnel on hydrofoils made to NACA sections 16-012 and 16-(0.15)12 and supplied by the Bassin des Carenes in Paris. Cavitation inception data were obtained at various water velocities and air contents and compared to data obtained in Paris and in Goteborg. These data show that cavitation inception occurred at the lowest values of cavitation number in the NSROC water tunnels. The results indicate that cavitation inception is greatly affected by the air content of the water to the extent, that either gaseous cavitation or vapor cavitation may occur. The presence of gaseous cavitation is noted at the higher air contents while the more common vapor cavitation occurs at the lower air contents. GRA

N76-15323# Naval Civil Engineering Lab., Port Hueneme, Calif.

SEA CACHE: A MOBILE PETROLEUM, OILS, LUBRICANTS (POL) SEAFLOOR STORAGE AND SUPPLY SYSTEM FOR ADVANCED BASES Final Report, Jul. 1972 - Jun. 1973

N. D. Albertsen and H. H. Haynes Nov. 1974 24 p refs

(ZE61512001)

(AD-A004936; CEL-TN-1360) Avail: NTIS CSCL 15/5

The structural and operational characteristics of a mobile petroleum, oils, lubricants, (POL) logistics system are presented. The system is based on using large prestressed concrete structures to transport and store up to 27,000 barrels of POL product. Transport of the POL filled structures is by surface tow and storage is on the sea floor in water depths to 600 feet. The system can operate in conjunction with military forces at advanced bases where the seafloor structure is emptied via pipeline to the beach. In this manner, many of the hazards associated with on-land storage of POL are avoided. The structural and operational analyses show that this system is feasible and is a logical approach to meeting the military's advanced base POL requirements of today and of the future. GRA

N76-15324# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

PERFORMANCE CHARACTERISTICS OF A LIQUID HELIUM PUMP Final Report

Paul R. Ludtke Jul. 1975 57 p refs Sponsored by AF

(AF Proj. 3145)

(AD-A014250; NBSIR-75-816; AFAPL-TR-75-40) Avail: NTIS CSCL 13/11

Part A of this report presents performance data for a simple, preinduced, single stage, centrifugal liquid helium pump powered by a close-coupled submersible cryogenic induction motor. Data on pump efficienvy and the motor efficiency are given, and the effects of decreasing the pump leakage loss and removing the preinducer were also investigated. Part B describes a study of the cavitation characteristics of the pump in liquid helium I. The net positive suction head at cavitation of the pump was extensively investigated, and found to be near zero; and effects of removing the inducer, changing the pump inlet geometry, and varying the hellium temperature were also determined. Author (GRA)

N76-15325# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

PRELIMINARY REPORT ON A FORTRAN 4 COMPUTER PROGRAM FOR THE TWO-DIMENSIONAL DYNAMIC BEHAVIOR OF GENERAL OCEAN CABLE SYSTEMS

Henry T. Wang Aug. 1975 25 p refs

(AD-A014328; SPD-633-01) Avail: NTIS CSCL 13/10

The present report describes program CABUOY, which analyzes in some detail the two-dimensional dynamic behavior of general ocean cable systems consisting of a surface buoy, connecting cable, and intermediate bodies. The report briefly presents the calculations which are carried out in the program, gives computer time requirements for several cable cases, and outlines some relatively small additional areas of work. Detailed input instructions are given in the Appendix. GRA

N76-15326# Bureau of Mines, Amarillo, Tex. Helium Operations Technical Services Unit.

ISOTOPIC PURIFICATION OF HELIUM BY DIFFERENTIAL DISTILLATION BELOW THE LAMBDA-POINT

Philip C. Tully Jul. 1975 25 p refs

(PB-244793/6; BM-RI-8054) Avail: NTIS HC $3.50 CSCL 07D

In a continuing effort to improve processes and methods of helium purification, a differential distillation at 4.2 to 1.6 K was used to reduce the helium-3 in helium-4 from about 200 to less than 1 part per billion by mole. The results from four stills ranging in size from 1 to 25 liters are reported. The method has the potential to be adapted to commercial-scale separations. GRA

N76-15327# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

DEVELOPMENT OF LOW-COST PHOSPHATE-FREE STEAM CLEANERS Interim Report, 1973 - 1975

T. R. Nichols Apr. 1975 18 p refs

(DA Proj. 1T1-62105-AH-84)

(AD-A014198; USAMERDC-2139) Avail: NTIS CSCL 11/11

The continuing investigation to develop a low-cost phosphate-free steam cleaner has resulted in two compositions that are approximately 10 and 45 percent more expensive than the high-phosphate comparison compound of Federal Specification P-C-437A. These represent a significant cost improvement over previously reported phosphate-free cleaners that were 200 percent more expensive. Author (GRA)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N76-15328 British Broadcasting Corp., Kingswood (England). Research Dept.

TIDAL FADING ON SHORT OVERSEA PATHS ELLIPTICAL, VERTICAL AND HORIZONTAL POLARISATION COMPARED

D. W. Taplin Nov. 1975 10 p refs

(BBC-RD-1975/34) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The effects of the rise and fall of tides and diffuse reflection at UHF on horizontally, vertically and elliptically polarized transmissions were investigated. It is concluded that distortion is most severe for horizontally polarized transmissions. Elliptical polarization would reduce the fading range but appears very susceptible to signal flutter due to diffuse reflection and in general vertical polarization will provide least distortion. It is also concluded that every effort should be made to avoid short sea paths between a UHF television station and its target area. Author

N76-15329* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SINGLE FREQUENCY, TWO FEED DISH ANTENNA HAVING SWITCHABLE BEAMWIDTH Patent

Richard F. Schmidt, inventor (to NASA) Issued 16 Dec. 1975 6 p Filed 4 Oct. 1974 Supersedes N74-34649 (12 - 24, p 2922

(NASA-Case-GSC-11968-1; US-Patent-3,927,408; US-Patent-Appl-SN-512825; US-Patent-Class-343-779; US-Patent-Class-343-837; US-Patent-Class-343-876) Avail: US Patent Office CSCL 17B

A switchable beamwidth antenna is described which includes a concave parabolic main reflecting dish which has a central circular region and a surrounding coaxial annular region. A feed means selectively excites only the central region of the main dish via a truncated subreflector for wide beamwidth or substantially the entire main dish for narrow beamwidth. In the embodiment shown, the feed means comprises a truncated concave ellipsoid subreflector and separate feed terminations located at two foci of the ellipsoid. One feed termination directly views all of the main dish while the other feed termination, exciting the main dish via the subreflector, excites only the central region because of the subreflector truncation.

Official Gazette of the U.S. Patent Office

N76-15330* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HORN ANTENNA HAVING V-SHAPED CORRUGATED SLOTS Patent

Leon Peters, Jr. (Ohio State Univ.) and Carl A. Mentzer, inventors (to NASA) (Ohio State Univ.) Issued 2 Dec. 1975 4 p Filed 24 Jul. 1974 Supersedes N74-29575 (12 - 19, p 2258) Sponsored by NASA

(NASA-Case-LAR-11112-1; US-Patent-3,924,237; US-Patent-Appl-SN-491419; US-Patent-Class-343-786) CSCL 17B

A corrugated horn antenna is disclosed in which the corrugated surfaces of the antenna are formed by V-shaped slots. The depth of the slots in between 0.3125 and 0.625 wavelengths. For this range of depths the surface impedance is capacitive and operates in a cut-off mode. The V-shaped corrugated slots are more easily machined than previous slots, and the resulting antenna is readily adaptable to unfurlable antennas for space applications. Official Gazette of the U.S. Patent Office

N76-15331*# Goodyear Aerospace Corp., Litchfield Park, Ariz.

SPACE SHUTTLE SYNTHETIC APERTURE RADAR Final Report

12 Aug. 1975 64 p Prepared for JPL

(Contract JPL-953053)

(NASA-CR-146078; GERA-2113) Avail: NTIS HC $4.50 CSCL 17I

Results of a feasibility study to investigate a digital signal processor for real-time operation with a synthetic aperture radar system aboard the space shuttle are presented. Pertinent digital processing theory, a description of the proposed system, and size, weight, power, scheduling, and development estimates are included.

N76-15332*# Gustincic (J. H.) Consulting Engineer, Marina Del Ray, Calif.

ONE-THIRD SCALE MODEL OF AN OFFSET FED SCANNING ANTENNA FOR THE SHUTTLE IMAGING MICROWAVE SYSTEM Final Report

J. H. Gustincic 25 Nov. 1975 31 p ref Prepared for JPL (Contracts NAS7-100; JPL-954145)

(NASA-CR-146081; TR-072) Avail: NTIS HC $4.00 CSCL 17I

An experimental study is reported, involving the design, fabrication, and measurement of a one-third scale model of the 4m diameter parabolic torus reflector with a Gregorian feed for the SIMS application. Antenna pattern measurements of the model at 60 and 30 GHz are presented to verify the predictions of a geometrical optics analysis upon which the antenna design was based. It is shown that the antenna measurements bear out the geometrical optics analysis in every respect and that the Gregorian subreflector feed is usable at all frequencies above at least 10 Ghz in the full size SIMS antenna. The fabrication of the model antenna is discussed, including a computerized technique for fabricating the transcendental subreflector shape with a numerically controlled machine. Author

N76-15333*# Ohio State Univ., Columbus. ElectroScience Lab.

NOISE PERFORMANCE OF VERY LARGE ANTENNA ARRAYS M.S. Thesis

Heng-Cheng Lin Sep. 1975 122 p refs

(Contract NAS5-20521)

(NASA-CR-144716; TR-3931-1) Avail: NTIS HC $5.50 CSCL 17B

The maximum size and resolution of receiving antenna arrays is found to be limited by signal-to-noise ratio considerations. For square arrays containing no active elements, a practical limit at 30 GHz appears to be on the order of 10 meters for communications and one to two meters for radiometry. These limitations can be overcome by use of active devices at various levels of the array organization. The nature of the resulting tradeoffs is indicated. Explicit formulas are developed for both passive and active arrays, and sample computations and the computer programs are given. Author

N76-15334# National Aviation Facilities Experimental Center, Atlantic City, N.J.

LABORATORY TESTS OF A DATA LINK MODEM Final Report, Oct. - Nov. 1974

Joseph A. Bilello Sep. 1975 25 p

(AD-A017065/4; FAA-NA-75-6; FAA-RD-75-134) Avail: NTIS HC $3.50 CSCL 17/2

The performance is evaluated of two minimum shift key modulation modems designed for very high frequency, data link communications. Tests consisted of determining the probable bit error of two modems in a loop-around mode for each modem and then in a back-to-back mode between the two modems. For each of these two test conditions, the modems were subjected to various signal-to-noise (S/N) ratios at the data rates of 2400 and 4800 bits/second. Each test was terminated after 800 bit errors were accumulated, except for those test runs where the modem was running essentially error free, the test period was limited to a 24-hour period. Results indicated that the performance of each modem was the same over the S/N ratios used, within a + or - 1-dB S/N tolerance. Author

N76-15335# Research Inst. of National Defence, Stockholm (Sweden).

INVESTIGATIONS INTO INTERFERENCE AT ARLANDA AIRPORT [INTERFERENSUNDERSOEKNING PA ARLANDA]

Lars Bergman and Ulf Tegth Apr. 1974 90 p refs In SWEDISH

(FOA-3-C-3782-E8) Avail: NTIS HC $5.00

Some telecommunication problems are analyzed for the air radio stations at Arlanda airfield to test working procedures in the use of data from the operation of telecommunication and the frequency register of the military authorities. The latter register gives the electronic environment in the surrounding neighborhood. Calculations show that the risk of interference is quite acceptable for the examined stations, which agrees with practical experience. The basis of collected data can be used to predict interference risks for future alterations or extensions to the radio equipment. The working procedures in the management of Tvt and the military frequency register are found to be well adapted to its purpose. Author

N76-15336# Research Inst. of National Defence, Stockholm (Sweden).

MICROWAVE TECHNOLOGY, COMPONENTS AND MATERIALS. A STUDY TRIP TO USA 1973, PART 2 [MIKROVAGSTEKNIK, KOMPONENTER OCH MATERIAL. STUDIERESA TILL USA 1973, DEL 2]

Erik Ljung Feb. 1974 23 p In SWEDISH

(FOA-3-C-3766-E8-Pt-2) Avail: NTIS HC $3.50

Impressions from a number of visits to commercial and government institutions in the U.S.A. are reported. They are mainly concerned with questions of microwave technology, e.g., measuring techniques, production methods and the direction of present day component development. Visits are arranged in chronological order, and the account is concluded with a short summary of the general attitude that could be traced during the journey. Author

N76-15337*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FREQUENCY STABILITY REQUIREMENTS FOR TWO WAY RANGE RATE TRACKING

Victor Reinhardt Dec. 1975 20 p refs Presented at Proc. of 6th NASA DOD PTTI meeting, Greenbelt, Md., 2-4 Dec. 1975

(NASA-TM-X-71040; X-814-75-315) Avail: NTIS HC $3.50 CSCL 17B

Accuracy limitations to two way range rate Doppler tracking due to master (reference) oscillator frequency instabilities are discussed. Theory is developed to treat both the effects of random and nonrandom oscillator instabilities. The nonrandom instabilities treated are drift, environmental effects, and coherent phase modulation. The effects of random instabilities on range rate accuracy are shown to be describable in terms of sigma y (2, T, tau). For the typical noise processes encountered in precision oscillators, range rate error is related to the more familiar sigma y (tau) and script L (f). Three examples are discussed to show how to determine range rate error from given sigma y (tau) or script L (f) curves, and approximations are developed to simplify the treatment of complex systems. An error analysis of range determined from rate data is also given. Author

N76-15338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REVIEW OF DATA ANALYSIS PROCEDURES FOR THE ATS-6 MILLIMETER WAVE EXPERIMENT

Robert Meneghini Aug. 1975 73 p refs

(NASA-TM-X-71023; X-951-75-235) Avail: NTIS HC $4.50 CSCL 17B

Predictions of satellite downlink attenuation through the use of ground based measurements form a substantial part of the ATS-6 millimeter wave experiment (MWE). At the downlink frequencies (20 and 30 GHz), the major causes of attenuation are the density and the size distribution of rain drops along the propagation path. Ground station data, which include radar and rain gauge records, measure quantities related to the meteorological parameters of interest and thereby provide a prediction of downlink attenuation with which the measured attenuation can be compared. The calibration and data analysis procedures used in the MWE are reviewed with the object of improving the accuracy of such ground based predictions. Author

N76-15339# Florence Univ. (Italy). Ist. di Elettronica.

STUDY ON ERROR DETECTION RELATING TO DATA COMPRESSION Final Report

C. Atzeni, C. Benelli, C. Bianciardi, V. Cappellini, G. Longo, L. Masotti, and A. Zanini Nov. 1974 189 p refs

(Contract ESOC-382/71)

(ESA-CR(P)-732) Avail: NTIS HC $7.50

Methods and techniques of error control (error detection and error correction) in the communication links between the ground receiving station and the control center were studied. The application of error control techniques in these links becomes particularly important when data received from satellites is set in a compressed form. The application of Burst Trapping (BT) codes is underlined. A generalized BT scheme based on a double encoding of each digit before transmission permits the correction of the random and burst error patterns introduced by a compound channel. Random errors introduced in the necessary guard space can also be corrected without a serious error propagation. ESA

N76-15340# Naval Research Lab., Washington, D.C.

INTERFERENCE-REJECTION PROPERTIES OF A QUANTIZED CORRELATOR APPLIED TO A KINEPLEX TYPE OF DATA TRANSMISSION SYSTEM Final Report

Jacob J. Freeman 21 Jul. 1975 26 p refs

(WF21222602; NRL Proj. R01-45)

(AD-A013989; NRL-7895) Avail: NTIS CSCL 17/2

Kineplex typically transmits an ensemble of about 20 pulsed tones, each of which is independently phase-shift keyed in quadrature by two binary streams. The Kineplex receiver employs matched filters using differentially coherent detection. Considerations of weight, cost, and size suggest the use of suboptimum but simpler devices employing quantized correlators (QC). Each tone requires a filter, especially to reduce interference from the unwanted tones. In a time-sampled variant of Kineplex detection, the interference from the unwanted tones can be completely eliminated in principle if the tone frequencies and the number of samples satisfy certain relations. Elimination of interference results from its coherence, which allows samples of the interfering signals to be summed properly so as to cancel. Although a QC injects quantization noise, reducing coherence, a 1-, 2-, 3-bit QC gave probability of error from interference of 0.33 0.03, 0.00003, respectively, for the worst case. GRA

N76-15341# Shape Technical Center, The Hague (Netherlands).

TECHNICAL SPECIFICATIONS FOR FREQUENCY DIVISION MULTIPLEX EQUIPMENT AND FIXED MICROWAVE SYSTEMS

Jun. 1975 159 p

(AD-A013646; STC-CR-NICS-6) Avail: NTIS CSCL 17/2

Contents: General technical specification for fixed line-of-sight FM/FDM radio relay systems and multiplex equipment; Microwave systems; High grade channel translating equipment; Through-group filter equipment; Through-supergroup filter equipment; Group AGC equipment; Supergroup AGC equipment; Group signal limiter equipment; Supergroup signal limiter equipment; Group translating equipment; Master oscillator and frequency generation equipment; Reference pilot supplies generation equipment; Supergroup translating equipment. GRA

N76-15342# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.

TRACKING ACCURACIES OF SEQUENTIALLY LOBED RADARS ON FLUCTUATING TARGETS

J. M. Loomis and M. D. Fahey 10 Jun. 1975 49 p refs

(DA Proj. 1M2-62303-A-214)

(AD-A013980; RE-75-34) Avail: NTIS CSCL 17/9

The effect of amplitude scintillation on a sequential lobing tracker has been analyzed. It is shown that the angular tracking accuracy is limited by the amount of target fluctuation if the target return signal fluctuates. A loss-of-track condition is found and is shown to give the same output as would be obtained from a Rayliegh distributed return signal. The report further shows that tracking targets with Swerling type I fluctuations is virtually impossible, while the tracking of type III targets is marginal. These results have direct application for a frequency scanned array which uses sequential lobing to angle track, because changing frequency will produce scintillation of target cross section, causing the return signal to fluctuate. GRA

N76-15343# Advisory Group for Aeronautical Research and Development, Paris (France).
AMPLITUDE SCINTILLATION OBSERVATIONS AND SYSTEMS APPLICATION
Herbert E. Whitney and Jules Aarons 17 Jun. 1975 30 p Repr. from Conf. Pre-Print No. 173 on Radio Systems and the Ionosphere (Athens), 26-30 May 1975 15 p
(AF Proj. 4643)
(AD-A011577; AFCRL-TR-75-0330) Avail: NTIS CSCL 17/2

For the design of a transionospheric communications link, scintillation data should be available to describe the statistics of adequate signal level, that is, the time durations that the signal power remains above specified levels, (the statistics of fades), and the time durations that the signal power remains below specified levels. The adequate signal level statistics assist designers in choosing data frame formats, message length, and estimating reliability of message reception. The fade statistics are useful in choosing coding and/or time diversity techniques to overcome this fading. Signal statistics of this type are illustrated using data recorded at equatorial, sub-auroral, and auroral latitudes. These signal statistics must be folded into a morphological pattern which contains statistics of scintillation fading as a function of geomagnetic latitude, instantaneous magnetic excursion, and local time. Recent data taken at auroral and sub-auroral latitudes have shown the effects on F layer irregularities of magnetic storms. In particular, the magnetic storms of August 1972 illustrate worst case scintillation levels. Data during the storm of October 31 - November 1, 1972 is used to show the correlation of scintillation with local magnetic variations. GRA

N76-15344# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
DEVELOPMENT OF A TRANSMISSION ERROR MODEL AND AN ERROR CONTROL MODEL
Joseph L. Hammond, Jr., James E. Brown, and Shyan-Shiang S. Liu May 1975 143 p
(Contract F30602-72-C-0409; AF Proj. 9567)
(AD-A013939; RADC-TR-75-138) Avail: NTIS CSCL 09/4

The objective of this study is to choose an error detecting code for use in general purpose digital communication networks which employ automatic repeat request. To choose a code it is necessary to characterize the channels used by the communication network. GRA

N76-15345# Army Engineer Topographic Labs., Fort Belvoir, Va.
BACKSCATTERING OF ELECTROMAGNETIC WAVES FROM A SLIGHTLY ROUGH SURFACE WITH A LOSSY LAYER
Dec. 1974 42096 p refs
(DA Proj. 4A7-62707-A-854)
(AD-A013863; ETL-TR-74-10) Avail: NTIS CSCL 20/14

The purpose of this report is to analyze the problem of electromagnetic wave scattering from a layer which is rough on both sides. A general vector theory is developed for horizontal and vertical polarizations in which use is made of the Fourier transform and the small perturbation theory. Although there has been a great deal of work performed in the area of electromagnetic wave scattering from plane-layered media, there has been very little work on the problem of wave scattering from a layer which has both interfaces rough. A solution to this problem is important if one is interested in such things as radar scattering from a layered road surface or from a terrain surface covered with ice. There are many other applications in which a solution to this problem would be of great aid. GRA

N76-15346# California Univ., Irvine. Dept. of Physics.
THEORY OF RAYLEIGH WAVE SCATTERING BY MASS DEFECTS AND SURFACE ROUGHNESS Interim Report
A. A. Maradudin, D. L. Mills, and R. F. Wallis 8 Aug. 1975 5 p refs
(Contract N00014-69-A-0200-9003; Grant AF-AFOSR-2887-76; AF Proj. 9763; NR Proj. 392-001)
(AD-A013680; Rept-75-29) Avail: NTIS CSCL 20/10

A Green's function method has been used to obtain an expression for the mean free path of a Rayleigh wave propagating along a planar free surface of an isotropic elastic continuum and scattered by a mass defect or a patch of surface roughness. GRA

N76-15347# Nicolet Scientific Corp., Northvale, N.J.
ENHANCING/INTELLIGIBILITY OF SPEECH IN NOISY OR MULTI-TALKER ENVIRONMENTS Final Technical Report, Apr. 1974 - Apr. 1975
T. W. Parsons and M. R. Weiss Jun. 1975 175 p refs
(Contract F30602-74-C-0175; AF Proj. 7055)
(AD-A013767; RADC-TR-75-155) Avail: NTIS CSCL 17/2

Two of the most serious types of interference in speech communications are wideband noise and the speech of a competing talker. This report describes research on techniques for coping with these types of interference. INTEL, a technique for enhancing speech obscured by wideband noise, has now been improved to the point that it will be realistic to implement it as a real-time system for use in practical applications. A technique has also been developed for dealing with interference from a competing talker. (The current technique is restricted to vocalic utterances). Separation is done by selecting the components of the desired voice in the Fourier transform of the input. In implementing this process, techniques have been developed for resolving overlapping spectrum components, for determining pitches of both talkers, and for assuring consistent separation. This report describes the improvements in INTEL and the implementation of the two-talker process, and discusses the prospects for basing a general two-talker process on these techniques. GRA

N76-15348# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
MONOPOLE ANTENNAS ON ELECTRICALLY THICK CONDUCTING CYLINDERS. VOLUME 1: EXPERIMENTAL DESIGN ADMITTANCE AND IMPEDANCE MEASUREMENTS Final Report, 1 Sep. 1967 - 31 Dec. 1974
Lee J. Cooper and Ronold W. P. King Jul. 1975 244 p refs 2 Vol.
(Contract N00014-67-A-0298-0005; NR Proj. 371-016)
(AD-A014113; TR-660-Vol-1) Avail: NTIS CSCL 09/5

A summary of research in electromagnetic phenomena is presented. This review consists of a logically arranged outline of topics with brief summaries and references to the relevant Technical Reports followed by a listing of all Technical Reports and publications resulting from these investigations. The main headings are: Antennas; Coupled Antennas and Arrays; Antennas and Waves in Dielectric, Conducting, or Plasma Media; and Miscellaneous Topics. The bulk of this two-volume report is comprised of the results of a rigorous experimental study of monopole and dipole antennas modified to have electrically thick conducting cylinders at their centers. This configuration has many practical applications including antennas on shipboard or spacecraft where the satellite, rocket frame, or ship's hull has physical dimensions on the order of a wavelength. Since no exact analytical formulation was available, the experimental design was precisely constructed to give the admittance, impedance, distributions of current and charge, and radiation patterns to a high degree of experimental accuracy. In this, the first volume of the report, a complete description of the experimental design, apparatus, and system of calibration is given along with the measured admittance and impedance results. GRA

N76-15349# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
MONOPOLE ANTENNAS ON ELECTRICALLY THICK CONDUCTING CYLINDERS. VOLUME 2: CURRENT AND CHARGE DISTRIBUTIONS, RADIATION PATTERNS, GENERAL INTERPRETATION OF DATA Final Report, 1 Sep. 1967 - 31 Dec. 1974
Lee J. Cooper Jul. 1975 264 p refs 2 Vol.
(Contract N00014-67-A-0298-0005; NR Proj. 371-016)
(AD-A014114; TR-660-Vol-2) Avail: NTIS CSCL 09/5

The results of a rigorous experimental study of monopole and dipole antennas modified to have electrically thick conducting cylinders at their centers are presented in this two-volume report. This configuration has many practical applications including antennas on shipboard or spacecraft where the satellite, rocket frame, or ship's hull has physical dimensions on the order of a wavelength. Since no exact analytical formulation was available,

the experimental design was precisely constructed to give the admittance, impedance, distributions of current and charge, and radiation patterns to a high degree of experimental accuracy. Distribution data were fitted with a least-squares polynomial which was used for normalization purposes and to compute the radiation fields. In this, the second volume of the report, the measured current and charge distributions are given along with radiation patterns obtained from direct measurements and calculated from the measured currents. The report closes with a general interpretation of the results and a discussion of their application to practical situations. Attention is directed to Volume I for a complete description of the experimental design, apparatus, and system of calibration, as well as measured admittance and impedance results. GRA

N76-15350# Center for Naval Analyses, Arlington, Va. Operations Evaluation Group.
MESSAGE CODING
Thomas L. Oberlin Apr. 1975 94 p ref
(Contract N00014-68-A-0091-0012)
(AD-A014581; CRC-279) Avail: NTIS CSCL 17/2

Shortcomings of the Standard Subject Identification Code (SSIC) are identified, and its performance is compared with that of an alternate subject code. Potential uses of the extra information that a good subject code provides are developed, as is methodology for evaluating message codes. GRA

N76-15351# California Univ., La Jolla. Dept. of Applied Physics and Information Science.
AN EXPENDABLE COMMAND TERMINATION RECEIVER SYSTEM FOR SCIENTIFIC BALLOON FLIGHTS Annual Technical Report, 1 Apr. 1974 - 31 Jul. 1975
P. Roger Williamson 31 Jul. 1975 32 p
(Contract N00014-69-A-0200-6053; NR Proj. 211-185)
(AD-A014472) Avail: NTIS CSCL 17/2

A lightweight, expendable command receiver has been developed for terminating scientific balloon flights. The receiver operates at 138.54 MHz and the command is actuated by a sliding tone from 300 Hz to 400 Hz. A Phase Locked Loop detector circuit operates an SCR firing circuit to actuate a gullotine type explosive cutter. Design information, schematic diagrams and construction details for the receiver are provided. An additional feature of the command receiver is the capability for measuring the slant range to the balloon. GRA

N76-15352# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
THE USE OF CODED COMMUNICATIONS TO OVERCOME IONOSPHERIC SCINTILLATION FADING Final Report, Dec. 1973 - Aug. 1974
Allen L. Johnson and John H. Garrett Apr. 1975 61 p refs
(AF Proj. 1227)
(AD-A014252; AFAL-TR-74-308) Avail: NTIS CSCL 17/2

In an effort to improve UHF satellite communications during the times it is affected by fonospheric scintillation fading, a simulation program was undertaken to investigate coding and interleaving. By making use of the times when the UHF signal is unfaded, it appears that forward error correcting coding can improve message readability. Interleaving of data bits is necessary to convert the long bursts of errors into a somewhat random error pattern which can be corrected by the coding. One-half rate binary feedback coding, one-half rate Viterbi coding and one-third rate Viterbi coding was tried. Various interleaving dimensions were also investigated. A UHF SATCOM channel with fading was simulated using actual scintillation fade data previously collected. The various types of coding/interleaving were played through the channel and the performance of each of these combinations was compared with the uncoded message. The results showed that an improvement in message readability can be achieved with coding/interleaving. Author (GRA)

N76-15353# Dikewood Corp., Los Angeles, Calif.
QUASI-STATIC FIELD PENETRATION INTO A TWO-DIMENSIONAL RECTANGULAR WELL IN A GROUND PLANE Final Report, 28 Sep. 1973 - 24 Jul. 1974
Lennart Marin Jul. 1975 28 p refs
(Contract F29601-74-C-0010; AF Proj. 3763)
(AD-A014326; AFWL-TR-74-246) Avail: NTIS CSCL 09/5

The penetration of quasi-static electric and magnetic fields into an indentation (a two-dimensional well) in a ground plane is studied with the aid of the Schwarz-Christoffel conformal mapping techniques. GRA

N76-15354# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
PLANAR NEAR-FIELD MEASUREMENT TECHNIQUES ON HIGH PERFORMANCE ARRAYS. PART 1: ERROR ANALYSIS FOR NONSCANNING BEAM PATTERNS Final Report, Jul. 1973 - Jul. 1974
Arthur D. Yaghjian Jul. 1975 122 p refs
(Contract F33615-73-M-6001; AF Proj. 2002)
(AD-A014397; AFAL-TR-75-6721-Pt-1) Avail: NTIS CSCL 09/5

General expressions are derived for estimating the errors in the sum or difference far-field pattern of electrically large aperture antennas which are measured by the planar near-field scanning technique. Upper bounds are determined for the far-field errors produced by (1) the nonzero fields outside the finite scan area, (2) the inaccuracies in the positioning of the probe, (3) the distortion and nonlinearities of the instrumentation which measures the amplitude and phase of the probe output, and (4) the multiple reflections. Computational errors, uncertainties in the receiving characteristics of the probe, and errors involved with measuring the input power to the test antenna are briefly discussed. GRA

N76-15355# National Bureau of Standards, Washington, D.C.
SYNCHRONOUS HIGH SPEED DATA SIGNALING RATES BETWEEN DATA TERMINAL EQUIPMENT AND DATA COMMUNICATION EQUIPMENT Final Report
George E. Clark 15 Jun. 1975 8 p
(COM-75-50500/8; FIPS-PUB-37) Avail: NTIS MF $2.25; SOD HC $0.40 as C13.52:37 CSCL 09B

The adoption is announced of the American National Standard X3.36-1975, for synchronous high speed data signaling rates. It is the same as Federal Standard Number 1001. This standard specifies a series of signaling speeds for synchronous high speed serial data transfer. GRA

N76-15356# National Bureau of Standards, Washington, D.C. Computer Systems Engineering Div.
CRITERIA FOR THE PERFORMANCE EVALUATION OF DATA COMMUNICATIONS SERVICES FOR COMPUTER NETWORKS
Dana S. Grubb and Ira W. Cotton Sep. 1975 39 p refs
(COM-75-11192/2; NBS-TN-882) Avail: NTIS HC $4.00 CSCL 09B

In general, when telecommunications services are used as a means of interchanging information between information processing systems, or between terminals and systems, a number of parameters determine how well that interchange is performed. The following characteristics of telecommunications services are examined: transfer rate; availability; reliability; accuracy; channel establishment time; network delay; line turnaround delay; transparency; security. These terms are all defined and their significance discussed. The effects of these factors on data communication networks are illustrated. GRA

N76-15357# Houston Univ., Tex.
THE ECONOMIC COMPARISON OF ONE-WAY PAGING AND FULL TWO-WAY RADIO SERVICE
Howard A. Plotkin 4 Apr. 1975 58 p refs
(COM-75-11141/9) Avail: NTIS HC $4.50 CSCL 17B

The study provides an in-depth look at the way in which two-way radio and one-way paging are used in many types of operations. Mathematical models are used to describe such utilization and to measure the economic benefits to the organization. GRA

N76-15358# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
A REVIEW OF LAND MOBILE RADIO
Vaughn Agy Jun. 1975 29 p
(COM-75-11148/4; OTM-75-200) Avail: NTIS HC $4.00 CSCL 17B

This report summarizes nongovernment use of land mobile radio (LMR). The services provided by LMR are described and

the spectrum allocations are outlined. A brief discussion of the present overcrowding of the LMR bands is given along with suggestions that could lead to its alleviation. GRA

N76-15359# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
FM-CW BOUNDARY LAYER RADAR WITH DOPPLER CAPABILITY
R. G. Strauch, W. C. Campbell, R. B. Chadwick, and K. P. Morgan May 1975 26 p refs
(COM-75-11154/2; NOAA-TR-ERL-329) Avail: NTIS HC $4.00 CSCL 17I

A high resolution FM-CW microwave boundary layer radar has been equipped with Doppler processing. The Doppler velocity spectrum is obtained from each range resolution cell by computing the power spectrum of the signal obtained from a sequence of consecutive sweeps. Target range is measured from the signal frequency by the usual FM-CW analysis techniques. Target velocity is obtained from a measurement of the signal phase in each sweep. The velocity spectrum of meteorological (distributed) targets can be measured whereas previously only the mean velocity of point targets could be obtained from this type of radar. Results obtained with snow tracers using a variety of sweep parameters demonstrate that the Doppler spectrum is easily obtained by a microwave FM-CW radar for altitudes below 2km. GRA

N76-15360# Softech, Inc., Waltham, Mass.
STRUCTURED ANALYSIS MODEL FOR NAVAL TELECOMMUNICATIONS PROCEDURES USERS MANUAL NTP 3 Interim Report
Clare Feldmann, Ken Schoman, and Dick Snyder Jul. 1975 121 p refs
(Contract N00173-75-C-0503; NRL Proj. B02-18; XF21241021)
(AD-A014583; NRL-MR-3086) Avail: NTIS CSCL 17/2

Structured Analysis is a technique devised by SofTech to model processes. This report contains a Structured Analysis model depicting the activities and data involved in the production of naval messages using the procedures defined in the document, Naval Telecommunications Procedures Users Manual NTP 3. GRA

N76-15361# RAND Corp., Santa Monica, Calif.
LOW DATA RATE GROUND WAVE COMMUNICATIONS OVER LAND Topical Report, 4 Sep. 1974 - 31 Aug. 1975
Cullen M. Crain 12 Aug. 1975 20 p refs
(Contract DNA001-74-C-0019; DNA Proj. NWED-QAXH)
(AD-A014117; DNA-3662T) Avail: NTIS CSCL 17/2

This report indicates the potential of ground wave communications under the assumed condition of no ionospheric transmission of either wanted signal or unwanted noise, a condition for which practical experience is generally lacking. It is shown that a system which can give reliable very low data rate transmission to distances of the order of 1000 miles during conditions of negligible ionospheric transmissions also is capable of providing reliable voice communications during normal conditions. Author (GRA)

N76-15362# Naval Postgraduate School, Monterey, Calif.
A FREQUENCY-DIVISION MULTIPLEX SYSTEM FOR USE IN SHIPBOARD INTERNAL VOICE COMMUNICATIONS M.S. Thesis
Daniel Edward Bienlien Jun. 1975 44 p refs
(AD-A014257) Avail: NTIS CSCL 17/2

A voice communications system that employs frequency-division multiplexing to add four voice channels to existing hardwired, audio-range circuits, is described. Phase-locked loop technology is used in the project, utilizing this new class of monolithic circuit. A study of an existing sound-powered telephone system is made and the compatibility of the multiplexing scheme within this system is investigated. Author (GRA)

N76-15363# Defense Communications Engineering Center, Reston, Va.
MULTICHANNEL QUEUEING SYSTEMS WITH HETEROGENEOUS CLASSES OF ARRIVALS
U. N. Bhat and M. J. Fischer Nov. 1974 38 p refs
(AD-A014541; TN-29-74) Avail: NTIS CSCL 17/2

DCEC engineering analyses indicate that the future Defense Communications System might be an integrated telecommunications network in which network voice and data would compete for use of the same transmission facilities. This Technical Note gives a complete analysis of the most fundamental operating rule for such a system. Different arrival and service rates for voice and data are used to develop analytic expressions for the blocking probability for voice and average delay for data. Furthermore, simple approximations for these system performance measures are given. Author (GRA)

N76-15364# Facility Checking Squadron (1866th) (AFCS), Richards-Gebaur AFB, Mo.
SPECIAL COMMUNICATIONS EVALUATION REPORT TRACALS Evaluation Report
Bruce E. Wallachy 15 Jul. 1975 37 p
(AD-A014344; Rept-75/66S-37) Avail: NTIS CSCL 17/2

This Special TRACALS Air-to-Ground communications evaluation report is a consolidation and in-depth analysis of the results of four evaluations on Rivet Switch and 4-channel keying equipment. The four evaluations were conducted at Altus AFB, OK, Eglin AFB, FL, Richards-Gebaur AFB, MO, and Vance AFB, OK. Included in this report are important equipment maintenance trends and system problems. The equipment maintenance trends include results of RF frequency accuracy, equipment meter circuit, and other transmitter and receiver test measurements. An alignment procedure for the Rivet Switch/4-channel key systems is presented and can be used throughout the Air Force for alignment and troubleshooting of air-to-ground communications systems. The principles presented in this report are applicable to all TRACALS communications systems. The concepts can be adapted for other transmitter, receiver, audio, and keying equipment. Author (GRA)

N76-15365# Culler/Harrison, Inc., Goleta, Calif.
EXPERIMENTAL INVESTIGATION OF THE OPTIMAL FILTER AS AN AREA FUNCTION PREDICTOR. SPEECH SIGNAL PROCESSING RESEARCH AT CHI Quarterly Technical Report, May-Jul. 1975
James F. McGill and Glen J. Culler Aug. 1975 84 p refs
(Contract DAHC15-73-C-0252; ARPA Order 2359)
(AD-A014579; CHI-QTR-102) Avail: NTIS CSCL 17/2

During the contract period reported here, the author has investigated the optimal filter as a predictor of area functions of acoustical cavities. A model is presented which predicts spectra of circular cylindrical cavities with uniform steps in the area function. The model is used to fit data derived from the measured impulse response of such cavities. The filter is found to be in error by a length factor in predicting the area function of the cavities. The accuracy of the technique is also sensitive to the spectral content of the signal near the Nyquist frequency. GRA

N76-15366# Little (Arthur D.), Inc., Cambridge, Mass.
COST AND TECHNICAL CHARACTERISTICS OF RADIO PAGING SYSTEM
13 Jun. 1975 35 p
(Contract COM-OT-0117)
(COM-75-11150/0; ADL-C-78058-TM) Avail: NTIS HC $4.00 CSCL 17B

The technical memorandum provides cost estimates and trends for both hardware and software elements of radio paging systems. GRA

N76-15367# Little (Arthur D.), Inc., Cambridge, Mass.
A GEOGRAPHIC ANALYSIS OF RADIO PAGING DENSITY, 1975 - 1985
13 Jun. 1975 21 p
(Contract COM-OT-0117)
(COM-75-11149/2; ADL-78058-TM-G) Avail: NTIS HC $3.50 CSCL 17B

The technical memorandum provides a basis for determining whether the projected 1985 population of 2.9 million pagers would be distributed in such a way as to create serious frequency congestion or channel crowding problems in any of the major U.S. urban areas. GRA

N76-15368# Mitre Corp., Bedford, Mass.
RADIO INFORMATION SYSTEM ARCHITECTURE

Jul. 1975 91 p refs
(Contract F19628-73-C-0001; AF Proj. 6370)
(AD-A014343; MTR-2869; ESD-TR-75-70) Avail: NTIS CSCL 17/2

This report summarizes the work which was completed during FY'74 on MITRE Project 6370, sponsored by the Electronic Systems Division of the Air Force Systems Command, to define the radio information system architecture for an airborne multiplex bus system. The work includes investigation of the transmission medium, experimental multiplex bus system design, and applications of a microprocessor. Author (GRA)

N76-15369# Defense Communications Engineering Office, Reston, Va. Computer Systems Div.
DEFINITION OF THE DCA SIMULATION PROGRAM
R. Choisser, P. Deering, C. Guffee, J. Hunter, and R. Lyons Aug. 1975 27 p refs
(AD-A014329; TN-11-75) Avail: NTIS CSCL 17/2

Definitions of terms specialized to the context of the systems engineering mission of the Defense Communications Agency are provided. These definitions are asserted to be technically correct and managerially useful. As background, the missions and functions of system engineering at the Defense Communications Engineering Center are described. Resources for system engineering are described with emphasis on requirements for decisions on use of in-house vs. outside facilities. GRA

N76-15370# Colorado Univ., Boulder.
CHARACTERISTICS OF ADAPTIVE BEAMFORMING METHODS IN AN HF BACKSCATTER ENVIRONMENT Final Report, 1 Jan. 1972 - 31 May 1975
Lloyd J. Griffiths Aug. 1975 92 p refs
(Contract F30602-72-C-0386; ARPA Order 1423)
(AD-A014354; RADC-TR-75-205) Avail: NTIS CSCL 17/9

The objective of this program is to investigate the advantages which may accrue to HF backscatter systems employing adaptive beamforming methods. The efforts were directed toward obtaining detailed information regarding the performance of time-domain adaptive beamforming methods in an HF backscatter environment. It was shown that the time scale of coefficient variation in an adaptive processor operating in this environment is the order of one second. Successful tracking of the P-vector algorithm under these conditions was demonstrated. The use of MTI clutter suppression filters at the subarray outputs, prior to adaptation, was investigated. No significant improvement was observed with the use of these filters on experimental data. A preliminary investigation into the effects of receive array aperture size on adaptive array performance has been carried out. It was shown that the presence of fading nulls can significantly effect the determination of optimal subarray location and spacing in an HF environment. In general, the adaptive beamformer performance was found to be less dependent upon array geometry than was the case for conventional processing. GRA

N76-15371# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
ON THE STATISTICAL ANALYSIS OF THE RADAR SIGNATURE OF THE MQM-34D Interim Report
James W. Wright 20 Mar. 1975 64 p refs
(DA Proj. 1X3-64307-D-212)
(AD-A014150; RE-75-21; IR-3) Avail: NTIS CSCL 17/9

The report contains the results of an analysis of the radar signature of the MQM-34D target drone for seven aspect angle regions for a horizontally polarized measurements system. The radar cross section (RCS) and glint are compared with classical models. The RCS falls off about 4.7 dB for a 30 degrees bistatic angle for the aspect regions less than 30 degrees from nose-on. For the aspect region between 30 degrees and 60 degrees from nose-on the fall-off is about 3 dB. The near broadside aspects show no apparent fall-off. The glint for the near nose-on aspects is about 11 feet monostatically and about 2 feet for the 30 degrees bistatic case. The near broadside aspects show larger glint, about 18 feet monostatically and about 7 feet for 30 degrees bistatic angle. GRA

N76-15372# Operations Research, Inc., Silver Spring, Md.
APPLICABILITY OF EXISTING EMERGENCY RADIO BEACONS IN A MARINE ENVIRONMENT Final Report, 1 Jul. - 16 Dec. 1974
E. Feinberg, A. Pieper, C. Prisekin, and G. Selz 30 Apr. 1975 79 p refs
(Contract DOT-CG-43019-A)
(AD-A014563; ORI-TR-918; USCG-D-110-75) Avail: NTIS CSCL 17/7

This report documents the first phase in the development of Emergency Radio Beacons (ERBs) for the marine environment. This first phase consisted of testing and analyzing existing Radio Beacons in order to prepare performance specifications for ERBs and associated DF/Homers. This study answered the questions: Are existing Emergency Locator Transmitters (ELTs) applicable in a marine environment. If they are not applicable what changes are required. Are there any technical limitations. What type of DF/Homing equipment should be used. Appendices A and B contain the initial performance specifications for the ERBs and DF/Homers. Author (GRA)

N76-15198* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CORRUPTION OF RADIO METRIC DOPPLER DUE TO SOLAR PLASMA DYNAMICS: S/X DUAL-FREQUENCY DOPPLER CALIBRATION FOR THESE EFFECTS
F. B. Winn, S. R. Reinbold, K. W. Yip, R. E. Koch, and A. Lubeley *In its* The Deep Space Network 15 Dec. 1975 p 88-101 refs (For availability see N76-15190 06-12)
CSCL 20N

N76-15200* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE X-BAND LOW NOISE ANTENNA MEASUREMENT CONE
M. S. Reid, F. E. McCrea, K. B. Wallace, and C. T. Stelzried *In its* The Deep Space Network 15 Dec. 1975 p 105-112 refs (For availability see N76-15190 06-12)
CSCL 17B

N76-15201* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF DSS 13 26-m ANTENNA AT X-BAND
A. J. Freiley *In its* The Deep Space Network 15 Dec. 1975 p 113-118 refs (For availability see N76-15190 06-12)
CSCL 17B

N76-15202* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS 14 X-BAND RADAR FEEDCONE
D. E. Neff and D. A. Bathker *In its* The Deep Space Network 15 Dec. 1975 p 119-131 refs (For availability see N76-15190 06-12)
CSCL 17B

N76-15204* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROCONTROLLER FOR AUTOMATION APPLICATION
H. W. Cooper *In its* The Deep Space Network 15 Dec. 1975 p 144-147 (For availability see N76-15190 06-12)
CSCL 17B

N76-15208* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYMBOL SYNCHRONIZER ASSEMBLY INSTABILITY STUDY, PART 2
R. C. Bunce *In its* The Deep Space Network 15 Dec. 1975 p 222-230 refs (For availability see N76-15190 06-12)
CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-15373* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE BERYLLIUM OXIDE CAPACITOR Patent

Russell A. Lindberg, inventor (to NASA) Issued 2 Dec. 1975 4 p Filed 28 Jan. 1975 Supersedes N75-16746 (13 - 08, p 0878)
(NASA-Case-LEW-11938-1; US-Patent-3,924,164; US-Patent-Appl-SN-544611; US-Patent-Class-317-258; US-Patent-Class-317-261) Avail: US Patent Office CSCL 09A

A capacitor suitable for use in environments where the temperature is as high as 1500 C is described. The capacitor is comprised of a BeO wafer which is off-sputtered on each side and an electrode of Iridium on each side which is deposited by sputtering, or ion plating. A barrier layer of BeO is deposited on one or both of the electrodes to prevent diffusion bonding of the electrodes of adjacent capacitors due to temperature, pressure, and vacuum when several capacitors are stocked.
Official Gazette of the U.S. Patent Office

N76-15374 Arizona State Univ., Tempe.
INVESTIGATIONS IN MICROWAVE TRANSISTORS Ph.D. Thesis
Robert Paul Arnold 1975 398 p
Avail: Univ. Microfilms Order No. 75-29911

Microwave power transistors are fabricated using four types of surface geometries: interdigitated, overlay, mesh and diamond. Previous analyses of these geometries were oversimplified and have led to contradictory conclusions. Detailed geometric and electrical analyses were made of these transistor structures in order to more fully understand the tradeoffs among performance, reliability and fabrication tolerances. Each of the four types of transistor geometries, including two variations of the overlay and mesh structures, is thoroughly analyzed. The analyses include the effects of photomask resolution limitations, which are shown to severely degrade the design parameters of the diamond geometry. A computer aided design system is established to facilitate the realization of a 48-transistor test vehicle matrix having eight geometric parameter permutations of each of the six device types. Dissert. Abstr.

N76-15375*# Scientific Translation Service, Santa Barbara, Calif.
DRIVING CYCLES FOR ELECTRIC URBAN VEHICLES AND METHODS FOR OBTAINING THEM
Wolf-Dieter Weigel Washington NASA Dec. 1975 16 p refs Transl. into ENGLISH from Elektrotechnische Zeitschrift Ausgabe (West Germany), v. 94, no. 3, Mar. 1973 p 142-146
(Contract NASw-2791)
(NASA-TT-F-16822) Avail: NTIS HC $3.50 CSCL 13F

Characteristic driving cycles are developed, based on calibrated runs for realistic comparative investigations on electrical drives for city vehicles. The cycles allow a realistic simulation of the loads for city traffic and give numerical data about the dimensions of such drive units. Author

N76-15376*# Scientific Translation Service, Santa Barbara, Calif.
CONTRIBUTION TO THE THEORY OF THE ELECTRIC VEHICLE
A. Walz Washington NASA Dec. 1975 33 p refs Transl. into ENGLISH from Elektrotech. Z. Ausgabe (West Germany), v. 94, no. 11, Nov. 1973 p 622-631
(NASw-2791)
(NASA-TT-F-16817) Avail: NTIS HC $4.00 CSCL 13F

The theory of a vehicle on wheels can be treated by classical mechanics to any degree of accuracy if the problem deals with the forces and mechanical energies to be a applied 'to the wheel' by the drive. In the case of an electrically driven vehicle, questions relating to the efficiency of energy conversion in the chain 'battery-drive' are more important, since the specific energy of the currently available energy storage device (the lead storage battery) is veay small. Accurate computations are shown to be possible for practically any kind of transportation program, except for the 'requirement at the wheel'. Several typical examples are given. The energy losses in battery and drive must be obtained from empirical laws which are sufficiently well established. Using analytic interpolation formulas for these laws, together with the mechanics of the vehicle, a semi-empirical theory of the electrical vehicle was formulated. The theory treats in simple analytical form problems of optimizing the electric vehicle, in particular, concerning the weight fraction of the battery, the range, and the transport work. Author

N76-15377*# Advanced Kinetics, Inc., Costa Mesa, Calif.
INSTRUCTION MANUAL, OPTICAL EFFECTS MODULE ELECTRONIC CONTROLLER AND PROCESSOR, MODEL OEMCP
14 Nov. 1975 39 p
(Contract NAS8-31334)
(NASA-CR-144125; Rept-1054-303) Avail: NTIS HC $4.00 CSCL 09A

The OEM-1 electronic module is discussed; it is comprised of four subsystems: the signal processing and display; the stepper motor controls; the chopper controls; and the dc-dc invertor. The OEM-1 module controls the sample wheel so that the relative transmittance of the samples can be compared to the clear aperture position. The 3-1/2 digit digital voltmeter displays the clear aperture signal level as well as the ratio of the remaining sample positions relative to the clear aperture position. The sample wheel position is decoded so that the signals and ratios can be correlated to the data. The OEM is automatically reset to the I sub o on initial turn-on and can be reset to the '0' position by actuating a front panel switch. The sample wheel can be interrupted to change samples or induce a longer integration time if desired by a front panel command. Integration times from 1 - 50 seconds are provided at the front panel, and BCD data for external interfacing is provided. Author

N76-15378# Mullard, Ltd., Southampton (England). Development Dept.
LINEAR L-BAND POWER AMPLIFIER Final Report
Jun. 1975 39 p
(Contract ESTEC-2000/73-HP)
(ESA-CR(P)-710) Avail: NTIS HC $4.00

Work carried out on the development and construction of a breadboard model for a 1.5 W RMS linear L-band amplifier is summarized. A transistor was specifically produced with the necessary inherent linearity which has enabled the electrical requirements to be met without recourse to amplifier linearizing techniques. The transistor produces in a Teflon circuit board amplifier 2.1 W RMS at -26 db intermodulation products under 3 carrier conditions with a 7.9 db gain at 42 % efficiency. An MIC amplifier was developed of overall dimension 73 x 43 x 12 mm, including connectors, weighing 48 gms. This amplifier produced 2.5 W at -26 db intermodulation products under 3 carrier conditions with a 7.3 db gain at 36 % efficiency. With white noise loading 2.5 W RMS was obtained at -25 db intermodulation products at 34 % efficiency. An FFT technique for the prediction of the intermodulation products from the amplifier transfer characteristics was employed which gives reasonable correlation with the measured results. Author (ESA)

N76-15379# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
A STUDY ON RADIATION PATTERN PREDICTION FOR HIGH FREQUENCY SATELLITE ANTENNAS Final Report
N. C. Albertsen, H. Bach, P. Balling, F. Jensen, K. Pontoppidan, L. Solymar, (Oxford Univ.), O. Soerensen, and N. E. Jensen, (ESTEC) Oct. 1975 181 p refs Prepared jointly with Ticra A/S
(Contract ESTEC-2290/74)
(R-145; ESA-CR(P)-729) Avail: NTIS HC $7.50

The prediction of satellite antenna radiation patterns using the Geometrical Theory of Diffraction (GTD) was further investigated to resolve imperfections. Multiply diffracted rays were introduced, and the diffractions by booms of a diameter comparable to the wavelength was investigated. Diffraction by a vertex and corrections to the field in caustic directions and in penumbra regions was studied. The ray tracing problem was also studied in particular for doubly diffracted rays on a finish circular cylinder and on a convex polyhedron. It is concluded that it is possible to predict radiation patterns by means of GTD, which are useful in many cases. Inaccuracies and discontinuities resulting from the method need to be resolved by alternative methods such as the equivalent current method and specialized asymptotic field expressions. (ESA)

N76-15380# Dikewood Corp., Los Angeles, Calif. Research Branch.
ELECTRICALLY SMALL ELLIPSOIDAL ANTENNAS Final Report, 28 Sep. 1973 - 24 Jul. 1974

K. S. H. Lee Jul. 1975 56 p refs
(Contract F29601-74-C-0010; AF Proj. 3763)
(AD-A013849; AFWL-TR-74-245) Avail: NTIS CSCL 09/5

Analytical and numerical results are obtained for the equivalent area, radiation resistance, polarizabilities, and field enhancement factors of an ellipsoid or a half ellipsoid symmetrically resting on an infinite ground plane. It is shown that a simple relationship exists among these quantities. GRA

N76-15381# Pulsar Associates, Inc., La Jolla, Calif.
HIGH VOLTAGE PULSER TECHNIQUES FOR ELECTROMAGNETIC PULSE (EMP) SIMULATORS Final Report, Sep. 1972 - Jun. 1974
J. Steven Granados, John T. Naff, Walter F. J. Crewson, and Charleton H. Jones, Jr. Jul. 1975 181 p refs
(Contract F29601-71-C-0121; AF Proj. 1209)
(AD-A013783; AFWL-TR-74-142) Avail: NTIS CSCL 14/2

This report presents the results of both theoretical and practical investigations aimed at improving the performance of a number of key components that are common to many EMP high voltage generators. The advantages of component redundancy over attempting to achieve extreme individual component reliability are outlined. Common capacitor faults are discussed together with methods of their detection and techniques for circumventing a failed capacitor in a Marx generator. Marx switch faults and timing irregularities are also discussed. A specific design for a high voltage fuse for use in Marx generator circuits which was developed and tested is presented. A cascade high voltage ropeswitch is discussed. GRA

N76-15382# Canada Superconductor and Cryogenics Co. Ltd., St. Lambert (Quebec).
AC LOSS AS A FUNCTION OF CURRENT AND EXTERNAL MAGNETIC FIELD IN COMMERCIAL NbTi SUPERCONDUCTORS Final Report, 1 Jul. 1973 - 31 Dec. 1974
D. Ho, M. C. Robinson, V. Srivastava, and R. Stevenson Wright-Patterson AFB, Ohio AFML Feb. 1975 92 p refs Sponsored in part by Defence Research Board of Canada
(Contract F33615-73-C-5163; AF Proj. 7371)
(AD-A014360; AFML-TR-75-23) Avail: NTIS CSCL 20/3

Alternating current loss as a function of current and external magnetic field in commercial NbTi superconductors has been measured with an electronic wattmeter. The loss varies as the current cubed, and the increase of loss with the external magnetic field could be related to the decrease of the d.c. short sample current with field. GRA

N76-15383# Kansas State Univ., Manhattan.
EFFECTS OF BRAID RESISTANCE AND WEATHERPROOFING JACKETS ON COAXIAL CABLE SHIELDING Final Report, 29 Nov. 1973 - 29 Jul. 1974
K. F. Casey Apr. 1975 66 p refs Prepared in cooperation with Dikewood Corp., Albuquerque, N. Mex.
(Contract F29601-74-C-0010; DNA Proj. NWED-EB-088)
(AD-A014439; AFWL-TR-74-208) Avail: NTIS CSCL 09/1

The effects of finite conductivity in the shield conductors and of the presence of dielectric weatherproofing jackets on coaxial cable shielding are investigated by considering three coaxial-cable shield models. The first of these is a bidirectionally conducting shel :he second is a concentric pair of counter-wound filamentary helices with a (possibly lossy) dielectric jacket. For each model, the transmission-line parameters are determined. Comparison of the results for the first two models indicate the importance of the woven shield structure, in that for the first model, the coupling impedance decreases exponentially as the shield thickness increases; and for the second, the decrease is generally only algebraic. The results for the third model indicate that a dielectric jacket tends to reduce the electric-field coupling to the interior of the cable, and that the finite resistance of the shield conductors for this case is not of great importance as long as it is small. GRA

N76-15384# Naval Research Lab., Washington, D.C.
THE NRL FLUID-COOLED HELIX TRAVELING-WAVE TUBE Final Report
H. D. Arnett, H. E. Brown, J. T. Jensen, Jr., R. H. Kyser, and S. T. Smith 31 Jul. 1975 60 p refs
(NRL Proj. R06-45; XF54545014)
(AD-A014413; NRL-7899) Avail: NTIS CSCL 09/1

In the conventional helix traveling wave tube the helix is supported by three of four ceramic rods between the helix and tube shell. The amount of average power attainable is limited by the amount of heat that can be conducted along the helix and across the ceramic supports. A fluid-cooled helix was designated that employs a helix made of copper tubing supported by hollow ceramic tubing brazed at each half turn of the helix. Several geometries of fluid flow and their effect on the RF design of the tube were tested. The cooling analyses indicate that it should be possible to dissipate at least five times as much power with the fluid cooling as with conventional thermal conduction for frequencies up through S-band. For some fluids the circuit RF losses increase rapidly with frequency above the operating frequency. This is useful for suppressing unwanted backward-wave oscillations. Experimental tubes were built and tested. Four kolowatts of average power was attained at 3 GHz in a design that was capable of octave bandwidth operation. GRA

N76-15385# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
VERTICAL CHANNEL METAL-OXIDE-SILICON FIELD EFFECT TRANSISTOR Annual Report, Aug. 1974 - Oct. 1975
T. M. S. Heng, J. G. Oakes, D. A. Tremere, R. A. Wickstrom, and H. C. Nathanson 1 Nov. 1974 67 p refs
(Contract N00014-74-C-0012; NR Proj. 251-013; RF54545001)
(AD-A014275) Avail: NTIS CSCL 09/1

A large gate periphery (6200 micrometer) vertical channel microwave silicon MOS transistor has been developed which is capable of operating up to a frequency of 4.5 GHz, and delivering more than 1.6W of linear Class A power at 0.5 GHz. The maximum drain current and voltage capabilities of the device are 1A and 32 volts respectively, and the saturated transconductance is over 0.12 mhos. A yield of greater than 50% has also been established in device fabrication. Based on these results, an even larger periphery device is projected to operate at frequencies much higher than 4.5 GHz. GRA

N76-15386# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
THERMOMECHANICAL TESTING TECHNIQUES FOR MICROCIRCUITS Final Technical Report, Mar. 1972 - Dec. 1974
M. R. Carpenter and W. Fitch May 1975 273 p refs
(Contract F30602-72-C-0251; AF Proj. 5519)
(AD-A014345; RADC-TR-75-134) Avail: NTIS CSCL 09/5

This study investigated the performance of more than 3,000 plastic and hermetic 14-lead integrated circuits in various temperature cycling and thermal shock step stress and extended cycle test sequences; interaction between thermal shock preconditioning on temperature cycling; and wire bond and seal strength degradation when subjected to more than 1,000 thermal cycles. Thermal analysis of 14-lead ceramic DIP was also studied. Glass transition temperature of the various plastics was measured. The latest plastic integrated circuit with large diameter wires was the best package on long term (greater than 4,000 cycles) thermal cycling. Flat packages were the best hermetic package. Major failure modes were grain boundary fracture in plastic integrated circuits and wire flex failures in hermetic. Temperature cycling affects the bonding wires whereas thermal shock affects the package hermeticity. Mean wire pull strength does degrade approximately 10% in 1,000 cycles, with some zero strength bonds occurring after 240 cycles. The ceramic dual-in-line glass seal shows an average degradation of 6.4 in-lbs/1,000 cycles in strength with extended cycling. The mean number of cycles to failure was 7,800. Author (GRA)

N76-15387# Stanford Univ., Calif. Microwave Lab.
ACOUSTIC WAVE SEMICONDUCTOR CONVOLVER APPLIED TO ELECTRICAL AND OPTICAL SIGNAL PROCESSING Interim Report
H. R. Gautier Jun. 1975 186 p refs
(Contract N00014-67-A-0112-0084; ARPA Order 2778)
(AD-A014564; SU-ML-2448) Avail: NTIS CSCL 09/5

This work presents an experimental and theoretical study of the interactions between acoustic surface waves on a piezoelectric

insulator and charge carriers in a neighboring semiconductor separated by a small airgap; and the application of these phenomena to signal processing and optical imaging. Although the two media are mechanically isolated, the electric field associated with the surface waves penetrate into the semiconductor and interact with its charge carriers. This interaction is nonlinear, and, in the case of two oppositely propagating surface waves, real time convolution is performed. A new theory of the convolution interaction, taking into account the possible presence of a depletion, inversion or accumulation layer at the surface of the semiconductor, resulting from a built-in or applied dc field is presented. Experimental measurements for both n- and p-type Silicon on Lithium Niobate systems are in very good agreement with this theory, and they lead to a novel technique of measurement of the surface state distribution on semiconductors. The silicon on lithium niobate structure used gives rise to one of the largest convolution efficiencies reported to date. Several signal processing applications are presented. They show the versatility of the device which can be employed as a programmable filter or a parametric processor. In addition, the first autocorrelation is demonstrated by cascading two convolvers. The acoustic convolver was adapted for the scanning of optical images. GRA

N76-15388# Naval Electronics Lab. Center, San Diego, Calif.
SUGGESTIONS FOR DESIGNERS OF NAVY ELECTRONIC EQUIPMENT, 1975 EDITION
Donald R. Brooks 1975 149 p refs Revised
(AD-A014296; NELC-TD-390) Avail: NTIS CSCL 09/3

This booklet is designed to serve as a handy check list for engineers during the development of naval electronic equipment. The objectives are to save engineering, development, and testing time and effort, and to increase operational availability of better electronic equipment. The suggestions are intended for equipment developed for the Naval Material Command, although most of them apply to all types of military electronic equipment. A booklet this size cannot hope to include all the volumes of engineering information and military requirements necessary for the design of naval electronic equipment. The intent is to alert the designer to possible trouble spots in his design, or to areas of conflict outside his realm of expertise or specialization. The sooner a design problem can be identified, the more easily it can be resolved. The design philosophy for naval electronic equipment is to utilize those techniques which increase reliability, improve maintainability, and reduce costs. GRA

N76-15389# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGNING PRINTED CIRCUIT BOARDS WITH THE AID OF A COMPUTER
Zoltan Bortsok, Janos Cserno, Jozsef Daniel, Jozsef Drasny, and Gabor Koszo 31 Jul. 1975 23 p refs Transl. into ENGLISH from Meres es Automatika (Hungary), v. 22, no. 1, 1974 p 23-29
(AD-A014408; FTD-ID(RS)I-1817-75) Avail: NTIS CSCL 09/5

This article describes the card-designing program system developed at the Coordinating Institute for Computer Engineering; it produces a perforated tape, capable of being used for controlling a drawing machine, from circuit logic data. The program segments dealing with the placement of integrated-circuit modules, leg interchanges, designation of printing routes, and preparation of perforated tape for drawing machine control are described in detail. Finally, a production tape prepared with the aid of the program is presented and the program running times are described. GRA

N76-15390# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE RACE-FREE AND MINIMAL COST CODING OF THE INTERNAL STATES IN COMPUTER AIDED DESIGN OF SEQUENTIAL SWITCHING SYSTEMS: ON THE PROGRAMMING SYSTEM RENDIS-S FOR THE DESIGN OF SEQUENTIAL SWITCHING SYSTEMS
G. Hallbauer 2 Jul. 1975 28 p refs Transl. into ENGLISH from Mes.-Steuern-Regeln (East Germany), v. 17, no. 3, Mar. 1974 p 95-102
(AD-A014521; FTD-ID(RS)I-1440-74) Avail: NTIS CSCL 09/2

A number of properties of a sequential switching system depend on the coding of the internal states. The coding, for example, has an effect on the logic element requirements, the speed of switching, and the memory requirements. Unclocked sequential switching networks may, in addition, exhibit so-called race conditions which result in faulty operation of the network. These race conditions are attributable to the non-ideal transition behavior of real components. The coding procedure described in the report was principally devised for the computer-aided design of industrial controls. GRA

N76-15391# High Voltage Power Corp., Westboro, Mass.
DESIGN AND TEST OF THREE-CONDUCTOR GAS-INSULATED CABLE Final Report
Jun. 1975 106 p refs
(Contract DI-14-01-0001-1560)
(PB-244392/7; EPRI-7816) Avail: NTIS HC $5.50 CSCL 09A

A three conductor compressed-gas-insulated cable was designed and compared on a technical and economic basis with conventional isolated phase gas cables. Also designed, fabricated, and tested was a 30 foot prototype piece of three conductor gas cable complete with elbows, trifurcation joint and three potheads. The conductor gas cables were found to have advantages over the isolated phase gas cables. A detailed economic analysis was performed which indicated that if the full ampacity of the gas cable can be utilized, three conductor gas cables are competitive and perhaps even less expensive than existing and proposed pipe cables insulated with either paper or polypropylene-cellulose. GRA

N76-15392# Edaw, Inc., San Francisco, Calif.
STUDY OF ENVIRONMENTAL IMPACT OF UNDERGROUND ELECTRIC TRANSMISSION SYSTEMS Final Report
May 1975 199 p refs Sponsored by Electric Power Research Inst. and Energy Research and Develop.
(PB-244434/7; EPRI-7826-FR) Avail: NTIS HC $7.50 CSCL 09C

The project was undertaken to examine present practices in underground power transmission, identify environmental impacts associated with those practices, and develop guidelines for reducing impacts where possible. Four basic types of underground transmission cable in commercial use were studied: high pressure oil filled (HPOF) pipe type, low medium pressure oil-filled (LPOF) self contained, extruded dielectric, and gas dielectric (SF6) cable systems. Both alternating current (AC) and direct current (DC) were considered in transmission voltages from 115 to 500 kilovolts (kV). The environmental analysis considers site conditions typical of those found throughout the U.S. The complete spectrum of impact-causing activities was evaluated. GRA

N76-15393# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTEGRATED OPTICAL CIRCUITS Semiannual Technical Summary Report, 1 Jul. - 31 Dec. 1974
Ivars Melngailis 31 Dec. 1974 15 p refs
(Contract F19628-73-C-0002; ARPA Order 2074)
(AD-A014254; ESD-TR-75-183) Avail: NTIS CSCL 20/6

Detailed measurements of the attenuation of high-purity planar GaAs waveguides have been made over the wavelength range from 0.90 to 1.06 micrometers. The loss, which appears to be primarily due to a band-edge absorption tail, ranges from 3.0 per cm at 0.90 micrometer to 0.3 per cm at 1.06 micrometers and is equal to or less than 1 per cm for lambda greater than 0.909 micrometer. These waveguides are suitable for use with si-doped GaAs-AlGaAs integrated lasers and with integrated electroabsorption detectors and modulators. Integrated structures consisting of Fabry-Perot GaAs-AlGaAs double-heterostructure lasers immersed in high-purity GaAs slab waveguides have been fabricated and characterized. These structures are quite attractive for use as sources in GaAs-based monolithic integrated optical circuits. Threshold current densities at room temperature as low as 7.5 kA per sq cm for 1-micrometer-thick active regions were measured. Measured external differential quantum efficiencies of the laser-waveguide combinations were about 3.5 percent, but appeared to be limited by the presence of internally circulating modes. Over three-orders-of-magnitude reduction of lattice-misfit dislocation densities in heteroepitaxial Pb(0.88)Sn(0.12)Te layers grown either by molecular beam or liquid-phase epitaxy

has been achieved by growing the layers on nearly lattice-matched PbTe(0.952)Se(0.048) substrates. GRA

N76-15394# Sperry Rand Research Center, Sudbury, Mass.
INTEGRATED OPTICAL SWITCHES Final Report, 1 Jun. 1974 - 31 May 1975
Richard A. Soref, Arthur R. Nelson, and Donald H. McMahon Jul. 1975 128 p refs
(Contract N00014-74-C-0321)
(AD-A014481; SCRC-CR-75-12) Avail: NTIS CSCL 20/6

Integrated optical switches for multimode fiber-optic communication systems have been investigated theoretically and experimentally. Thick film (20 to 100 lambda) optical waveguide structures are judged optimum for the switching devices. The first part of this report shows how the authors arrived at the thick-film technology approach. The principle of optical brightness conservation imposes theoretical limits on the maximum energy transfer between various fiber and film geometries. The consequences of the coupling limits on fiber-optic systems are spelled out in Sec. 2. Two types of fiber-optic switches, refractive and diffractive, are described in Sec. 3. Experimental results are presented for acoustooptic Bragg devices, and electro-optic multi-prism devices. Section 4 presents a detailed computer analysis of a phase modulation switch, which consists of a relative phase shifter for TE and TM modes (an electro-optic polarization rotator) and a passive beam-discriminator. GRA

N76-15199* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A 100-kHz FREQUENCY DIVIDER, DISTRIBUTION AMPLIFIER
G. Lutes *In its* The Deep Space Network 15 Dec. 1975 p 102-104 (For availability see N76-15190 06-12)
CSCL 09C

N76-15205* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXCITER SWITCH
W. L. McPeak *In its* The Deep Space Network 15 Dec. 1975 p 148-183 refs (For availability see N76-15190 06-12)
CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-15395 Connecticut Univ., Storrs.
AN INVESTIGATION OF VARIABLE ENERGY BLAST WAVES Ph.D. Thesis
Mark Nathaniel Director 1975 188 p
Avail: Univ. Microfilms Order No. 76-1665

A theoretical and experimental investigation of spherical blast waves was undertaken where the energy input is varied linearly with time. The theoretical investigation is based upon a finite difference formulation of the conservation equations in Lagrangian coordinates. Propagation and decay of the shock front, as well as the internal flow field properties, i.e., density, pressure and velocity, were obtained for air and chloroform. Experimentally, blast waves in gases of various specific heat ratios were induced by a high energy pulsed ruby laser. Both Q-switched and open lase output were used. The open lase output was used to approximate the linear energy input with small, discrete, step-like increments. Flow field data were obtained during and subsequent to the energy input interval utilizing a Mach-Zehnder interferometer in conjunction with a high speed rotating mirror framing camera. Shock trajectories in the form of radius-time (R-t) plots were obtained from the camera records. Dissert. Abstr.

N76-15396 Connecticut Univ., Storrs.
AN EXPERIMENTAL STUDY OF THE ROUND BUOYANT JET Ph.D. Thesis
Leonard Irving Hafetz 1975 412 p
Avail: Univ. Microfilms Order No. 76-1677

An experimental study of the round, turbulent, buoyant jet discharging through a single submerged diffuser into a large, quiescent, non-stratified receiving medium is presented. Plume characteristics were determined using temperature measurements from numerous combinations of discharge angle, Froude number, and depth. These test configurations covered a range of conditions broad enough to allow general analytic and experimental verification of the rising plume. In addition, the discharge variable range was chosen to cover most practical cases of interest anticipated in the design of diffusers for hot effluent discharge into a semi-infinite, cooler receiving media. Further in depth experimental studies were made to determine surface effects in particular and to analyze signal fluctuations over the entire test spectrum and their relation to experimental accuracy. Dissert. Abstr.

N76-15397 Northwestern Univ., Evanston, Ill.
INFLUENCE OF SURFACE ROUGHNESS AND WAVINESS ON THE FILM THICKNESS AND THE PRESSURE DISTRIBUTION IN ELASTOHYDRODYNAMIC CONTACTS Ph.D. Thesis
Lorac Shiu-Hay Chow 1975 162 p
Avail: Univ. Microfilms Order No. 75-29601

The Christensen theory of a stochastic model for hydrodynamic lubrication of rough surfaces is extended to elastohydrodynamic lubrication between two rollers. The Grubin-type equation including asperity effects in the inlet region is derived. Solutions for the reduced pressure at the entrance as a function of the ratio of the average nominal film thickness to the r.m.s. surface roughness (in terms of standard deviation sigma), were obtained numerically. Results were obtained for purely transverse as well as purely longitudinal surface roughness for cases with or without slip. The reduced pressure is shown to decrease slightly by considering longitudinal surface roughness. The transverse surface roughness, on the other hand, has a slight beneficial effect on the average film thickness at the inlet. The same approach was used to study the effect of surface roughness on lubrication between rigid rollers and lubrication of an infinitely-wide slider bearing. Dissert. Abstr.

N76-15398 Johns Hopkins Univ., Baltimore, Md.
CONSTITUTIVE RELATIONS IN THE KINETIC THEORY OF GASES Ph.D. Thesis
Robert Gary Muncaster 1975 120 p
Avail: Univ. Microfilms Order No. 76-1493

Thermomechanical theories of gases fall into two general categories, one consisting of the kinetic theory of gases, the other encompassing continuum theories of fluids. One of the basic ingredients of theories of the latter type is the specification of constitutive relations, these being equations which define the stress and heat flux as functions of the fields of density, velocity, and temperature. They contain the appropriate information about the type of gas being modeled. In contrast to this, the kinetic theory describes a gas through a molecular density function F, and a fundamental axiom in the theory is the requirement that this function satisfy the Maxwell-Boltzmann equation, an integro-differential equation which contains the relevant information about the gas as described by the properties of its molecules. The question of whether constitutive relations are present in the kinetic theory is discussed. Dissert. Abstr.

N76-15399 Connecticut Univ., Storrs.
AN INVESTIGATION OF THE SOLIDIFICATION OF A FLOWING LIQUID ON A CIRCULAR CYLINDER IN CROSS-FLOW AND ITS EFFECTS ON THE DRAG COEFFICIENT Ph.D. Thesis
Frederick Michael Carlson 1975 142 p
Avail: Univ. Microfilms Order No. 76-1658

The problem of two-dimensional transient solidification on a cold circular cylinder centered in a channel of flowing water was solved numerically in a quasi-steady manner. The fluid field was divided into an inviscid far field and a viscous boundary layer flow in the vicinity of the moving interface of the solidifying layer. A one-dimensional closed form solution was used to solve for an initial ice layer. Subsequently the inviscid velocity field was solved by a finite element technique. The flow separation point and the convective heat flux along the interface was predicted. The solid phase temperature distribution was found.

A net heat imbalance at the interface applied over a time interval resulted in a quantity of ice being formed. This process was repeated until ice ceased to form. A comparison between the analytical method and experimental results shows good agreement. Dissert. Abstr.

N76-15400 Purdue Univ., Lafayette, Ind.
PARTICLE DIFFUSION IN TWO-DIMENSIONAL TURBULENCE Ph.D. Thesis
Wei-Chung Chen 1975 233 p
Avail: Univ. Microfilms Order No. 76-509

Particle diffusion in a steady two-dimensional turbulent field was studied. The turbulent velocity was numerically generated by direct integration of the Navier-Stokes equations in their Fourier space form. The Basset-Boussinesq-Oseen equations which govern the motion of particles in a flow field were then numerically solved over the turbulent field. Upon knowing the motion of the particle ensemble, the density of the particle field was obtained by solving the continuity equation. Some diffusion properties (fluid and particle) were studied both from the Eulerian and the Lagrangian point. The experiments show that notwithstanding the small amount of relative diffusion, the particle concentration can vary rapidly. In particular it is shown that an initially uniformly dense particle ensemble tends to form low density 'pockets' and high density 'filaments'. Other diffusive properties, including self diffusion and relative diffusion are amply illustrated by means of computer graphs. Dissert. Abstr.

N76-15401 Purdue Univ., Lafayette, Ind.
AN EXPERIMENTAL INVESTIGATION OF A THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER Ph.D. Thesis
Donald Ralph Zimmerman 1975 149 p
Avail: Univ. Microfilms Order No. 75-608

An experiment was conceived to generate a simple, shear driven three dimensional turbulent boundary layer and measure every term in the governing equations. The experiment utilized a three wire hot wire probe which measured three orthogonal instantaneous velocity components simultaneously. The experimental model was a skewed leading edge, flat plate in zero pressure gradient air flow. This configuration yielded high cross stream gradients of the turbulent properties. Detailed distributions of Bradshaw's three scale parameters are prssented in regions both close to and far from equilibrium. In near equilibrium regions, qualitative agreement was obtained with the theoretical model of Bradshaw. In constrast, however, the conventional eddy viscosity formulation in the cross-stream direction was shown to be invalid. Dissert. Abstr.

N76-15402 Cincinnati Univ., Ohio.
QUASI-THREE-DIMENSIONAL VISCID/INVISCID INTERACTIONS INCLUDING SEPARATION EFFECTS Ph.D. Thesis
Veer Narain Vatsa 1975 121 p
Avail: Univ. Microfilms Order No. 75-745

Viscous/inviscid interactions in two and quasi-three-dimensional supersonic flows with separation were studied. The interaction effects are modeled through the so called displacement body concepts, where it is assumed that the inviscid flow sees an effective body obtained by adding the displacement thickness of the original surface. This facilitates the calculation of the induced pressure gradient as a function of the boundary layer growth and couples the inviscid and viscous flow through the pressure gradient parameter. The governing equations in the viscous region are taken to be the interacting boundary layer equations, written here in terms of the Levy-Lees variables. The inviscid pressure is related to the slope of the effective displacement body through approximate but well tested pressure laws, the remaining inviscid quantities being obtained through the use of isentropic relations. Dissert. Abstr.

N76-15403 Polytechnic Inst. of New York.
ON THE STABILITY OF SHOCK WAVES OF GENERAL STRENGTH WITH VISCOSITY AND HEAT CONDUCTION Ph.D. Thesis
James V. Valentino 1975 60 p
Avail: Univ. Microfilms Order No. 75-21408

The problem of stability according to the unsteady Navier-Stokes equations for the case of a shock wave of general strength with viscosity and heat conduction is considered. Stability for both real and complex domains is proven by assuming a Frobenius series solution to a set of previously developed differential equations with an eignvalue and with regular singular points at both ends. It is shown that solutions satisfying the boundary conditions will exist only for eigenvalues with negative real parts, corresponding to stable modes. Some actual solutions for the disturbances are also shown. Dissert. Abstr.

N76-15404*# Scientific Translation Service, Santa Barbara, Calif.
NUMERICAL INVESTIGATION OF THE MOTION OF A NONISOTHERMAL VISCOUS FLUID CONTAINING A BUBBLE, UNDER CONDITIONS OF MODERATE GRAVITATION
T. V. Kuskova and V. I. Polezhayev Washington NASA Jan. 1976 28 p refs Transl. into ENGLISH from Vychesl. Metody i Programmirovaniye (USSR), no. 23, 1974 p 54-75
(Contract NASw-2791)
(NASA-TT-F-16842) Avail: NTIS HC $4.00 CSCL 20D

The onset of motion in a heated spherical vessel containing a spherical gas bubble at the center of the vessel is examined. The problem is studied numerically for three possible modes: pure weightlessness, where mass forces are absent, a weak gravitational field when only natural convection will occur, and for the combined effect of natural and thermocapillary convection. Author

N76-15405*# Chrysler Corp., New Orleans, La. Space Div.
HEAT-FLUX GAGE MEASUREMENTS ON A FLAT PLATE AT A MACH NUMBER OF 4.6 IN THE VSD HIGH SPEED WIND TUNNEL, A FEASIBILITY TEST (LA28)
Dec. 1975 109 p refs
(Contract NAS9-13247)
(NASA-CR-144582; DMS-DR-2280) Avail: NTIS HC $5.50 CSCL 20D

The feasibility of employing thin-film heat-flux gages was studied as a method of defining boundary layer characteristics at supersonic speeds in a high speed blowdown wind tunnel. Flow visualization techniques (using oil) were employed. Tabulated data (computer printouts), a test facility description, and photographs of test equipment are given. Author

N76-15406*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
CERTAIN PROBLEMS AND METHODS OF THE LINEAR THEORY OF HYDRODYNAMIC STABILITY
V. Ya. Shkadov Washington NASA Dec. 1975 240 p Transl. into ENGLISH from "Nekotoryye Metody i Zadachi Teorii Gidrodinamicheskoy Ustoychivosti", Moscow State Univ., Inst. of Mech., Sci. Trans. no. 25, Moscow, 1973 p 1-192
(Contract NASw-2789)
(NASA-TT-F-16566) Avail: NTIS HC $8.00 CSCL 20D

The solution of nonlinear problems involves some principal and technical difficulties. Therefore, in addition to numerical solutions, an attempt is made to obtain solutions, using approximation methods. Basic methods for solving a problem for its own values in the Orr-Sommerfeld equation are outlined. Nonlinear interaction of disturbances and the determination of primary wave frequencies and lengths are given considerable attention. Author

N76-15407*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENTS OF MEAN FLOW AND ACOUSTIC POWER FOR A SUBSONIC JET IMPINGING NORMAL TO A LARGE RIGID SURFACE
Arthur P. Schloth Jan. 1976 49 p refs
(NASA-TM-X-72803) Avail: NTIS HC $4.00 CSCL 20D

An experimental study was made to measure the mean flow field and acoustic power of a subsonic jet impinging normal to a large rigid surface. A 6.25 cm diameter, circular cool air jet was used at heights of 20, 10, and 5 jet diameters above the surface. The jet exit Mach number was varied from 0.28 to 0.93. Impact and static pressure surveys were made in directions both axial and lateral to the jet axis and also parallel and perpendicular to the surface. Acoustic power was calculated from microphone measurements made during each test run using a diffuse field calibration for the test facility. Results indicate that

the flow field for jet impingement is characterized mainly by a strong rise in static pressure in the impingement region near the surface and by boundary layer development in the wall jet region. Acoustic power measurements generally followed a U(8) law for both the free jet and jet impingement although there was some variation especially at high Mach number and for close impingement distances. Overall noise levels increased with decreasing jet-to-surface height. Normalized power spectra correlated well for all cases when the Strouhal number was greater than 0.2; the correlation was poor when the Strouhal number was low. Author

N76-15408*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MONTE CARLO CALCULATIONS OF DIATOMIC MOLECULE GAS FLOWS INCLUDING ROTATIONAL MODE EXCITATION

Kenneth K. Yoshikawa and Yukikazu Itikawa Washington Jan. 1976 50 p refs

(NASA-TN-D-8100; A-6196) Avail: NTIS HC $4.00 CSCL 20D

The direct simulation Monte Carlo method was used to solve the Boltzmann equation for flows of an internally excited nonequilibrium gas, namely, of rotationally excited homonuclear diatomic nitrogen. The semi-classical transition probability model of Itikawa was investigated for its ability to simulate flow fields far from equilibrium. The behavior of diatomic nitrogen was examined for several different nonequilibrium initial states that are subjected to uniform mean flow without boundary interactions. A sample of 1000 model molecules was observed as the gas relaxed to a steady state starting from three specified initial states. The initial states considered are: (1) complete equilibrium, (2) nonequilibrium, equipartition (all rotational energy states are assigned the mean energy level obtained at equilibrium with a Boltzmann distribution at the translational temperature), and (3) nonequipartition (the mean rotational energy is different from the equilibrium mean value with respect to the translational energy states). In all cases investigated the present model satisfactorily simulated the principal features of the relaxation effects in nonequilibrium flow of diatomic molecules. Author

N76-15409*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MEAN FLOW FIELD AND SURFACE HEATING PRODUCED BY UNEQUAL SHOCK INTERACTIONS AT HYPERSONIC SPEEDS

Stanley F. Birch and David H. Rudy Washington Dec. 1975 74 p refs

(NASA-TN-D-8092; L-10444) Avail: NTIS HC $4.50 CSCL 20D

Mean velocity profiles were measured in a free shear layer produced by the interaction of two unequal strength shock waves at hypersonic free-stream Mach numbers. Measurements were made over a unit Reynolds number range of 3,770,000 per meter to 17,400,000 per meter based on the flow on the high velocity side of the shear layer. The variation in measured spreading parameters with Mach number for the fully developed flows is consistent with the trend of the available zero velocity ratio data when the Mach numbers for the data given in this study are taken to be characteristic Mach numbers based on the velocity difference across the mixing layer. Surface measurements in the shear-layer attachment region of the blunt-body model indicate peak local heating and static pressure consistent with other published data. Transition Reynolds numbers were found to be significantly lower than those found in previous data. Author

N76-15410*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A COMPARISON OF MEASURED AND PREDICTED TEST FLOW IN AN EXPANSION TUBE WITH AIR AND OXYGEN TEST GASES

Kenneth V. Aaggard and William K. Goad Washington Dec. 1975 35 p refs

(NASA-TN-D-8068; L-10356) Avail: NTIS HC $4.00 CSCL 20D

Simultaneous time-resolved measurements of temperature, density, pitot pressure, and wall pressure in both air and O2 test gases were obtained in the Langley pilot model expansion tube. These tests show nonequilibrium chemical and vibrational relaxation significantly affect the test-flow condition. The use of an electromagnetic device to preopen the secondary diaphragm before the arrival of the primary shock wave resulted in an improvement in the agreement between the measured pitot pressure and the value inferred from measured density and interface velocity. Boundary-layer splitter plates used to reduce the wall boundary layer show that this disagreement in the measured and inferred pitot pressures is not a result of boundary-layer effects. Author

N76-15411# Societe Nationale Industrielle Aerospatiale, Paris (France).

DETERMINATION OF INCOMPRESSIBLE FLOW PROFILES USING AN INVERSION METHOD [METHODE INVERSE DE DETERMINATION DE PROFILS EN INCOMPRESSIBLE]

Y. Morchoisne Assoc. Aeron. et Astronautique de France 1975 23 p In FRENCH Presented at the 11th Assoc. Aeron. et Astronautique de France Colloq. d'Aerodyn. Appl., Bordeaux, 6-8 Nov. 1974

(AAAF-NT-75-16; ISBN-2-7170-0334-7) Avail: NTIS HC $3.50; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

A method for determining the profile of an incompressible nonviscous liquid flow is presented. The method, based on inversion, although not unique, is distinguished from other methods in its being nearly completely automatic, while the precision is not limited by the capacity of the computer. The precision and the computer time are of the same order of magnitude as those of direct singularity methods. ESA

N76-15412# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).

MEASUREMENT OF THE CONCENTRATION OF NITROGEN DIOXIDE IN A HYPERSONIC AIR FLOW USING A LASER RADIATION ABSORPTION METHOD [MESURE DE LA CONCENTRATION DU BIOXYDE D'AZOTE PAR UNE METHODE D'ABSORPTION D'UN RAYONNEMENT LASER DANS UN ECOULEMENT D'AIR EN HYPERSONIQUE]

Jean-Pierre Serrano Paris Assoc. Aeron. et Astronautique de France 1975 55 p refs In FRENCH Presented at the 11th Assoc. Aeron. et Astronautique de France Colloq. d'Aerodyn. Appl., Bordeaux, 6-8 Nov. 1974

(AAAF-NT-75-19; ISBN-2-7170-0337-1) Avail: NTIS HC $4.50; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

A method using the laser ray absorption in the infrared was developed. The blowdown wind tunnel C1 for high Mach number and high enthalpy tests is described. The experimental equipment to measure the concentration of nitrogen monoxide in a hypersonic unsteady air flow by the infrared absorption method is presented. It includes a carbon monoxide laser to provide a 5.215 mu radiation in coincidence with a nitrogen monoxide absorption ray, a Perkin-Elmer spectrograph, and the C1 wind tunnel, where the tests were carried out. The principle and performance of the method to measure the NO concentration are presented and discussed. The experimental results have proven the presence of NO and confirmed the non-equilibrium hypothesis. ESA

N76-15413# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

TWO-DIMENSIONAL FLOW AROUND A MODEL IN PERIODIC MOTION

Henri Werle and Marc Gallon 1974 35 p refs In FRENCH; ENGLISH summary

(ONERA-NT-239) Avail: NTIS HC $4.00

A synthetic survey of various visualizations acquired at the Chatillon water tunnel since the beginning of its operation in 1951 by classifying according to the model shape (cylinder, flat plate, aerofoil without or with flap) and the nature of the movement (angular oscillations, alternate translation, uniform rotation, etc.), is presented. Among the visualizations obtained many concerned the two-dimensional flow around an obstacle subjected to a non stationary movement of periodical character. In each case, visualizations show the outline of the phenomena and the relative importance of the various parameters governing the motions studied, whose purpose and applications are also specified. Author (ESA)

N76-15414# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

COMPACT VELOCIMETER FOR MEASUREMENTS IN HIGHLY TURBULENT FLOWS Ph.D. Thesis - Paris Univ, 24 Oct. 1974

Alain Boutier Mar. 1975 143 p refs In FRENCH; ENGLISH summary Report will also be announced as translation

(ONERA-NT-237) Avail: NTIS HC $6.00

Laser anemometry is a technique for measuring local velocities in fluid flows. A compact velocimeter was designed for use in wind tunnels. The optimum optical configuration was chosen according to the nature and concentration of the particles present within the aerodynamic flows. A special beam splitter was devised; calculation of intensity distribution within the measured volume permitted a determination of the maximum dimensions of this volume and their evolution as a function of various parameters. Signal processing is performed by means of spectral analysis. Velocity profiles in a supersonic (Mach 3) mixing zone were determined, as well as the corresponding turbulence profiles; boundary layer probings in transonic flow around an aerofoil showed both the possibilities and the limitations of the method. Author (ESA)

N76-15415# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

THE HYDRAULIC TEST TUNNEL AT THE SERVICE OF AEROSPACE RESEARCH

Henri Werle Dec. 1974 87 p refs In FRENCH; ENGLISH summary Original contains color illustrations

(ONERA-P-156) Avail: NTIS HC $5.00

For over twenty years ONERA has operated at its Chatillon Center near Paris, a hydraulic test tunnel devoted to the visualization of flows at low speed. This long period of uninterrupted service made it possible to extend widely the possibilities and performance of the installations and their equipment, improve test methods, and take up a large variety of studies concerning both fundamental research and applications in the aerospace or industrial field. An up to date description of this experimental technique is presented and a survey of the most notable results given. Author (ESA)

N76-15416# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

AERODYNAMIC CHARACTERISTICS OF A 10 DEG SHARP CONE AT HYPERSONIC SPEEDS AND HIGH ANGLES OF ATTACK

George S. Pick, Samuel E. Dawson, and Robert L. Walker Jun. 1975 31 p refs Presented at the 9th Navy Symp. on Aeroballistics, Silver Spring, Md., 9-11 May 1972

(AD-A013598; Aero-1211; NSRDC-4692) Avail: NTIS CSCL 20/4

A free flying instrumented model was tested in a hypersonic facility at M = 5.30, 6.34 and 9.94 and Re = 300,000 to 1,200,000 feet. Aerodynamic lift, total drag and base drag coefficients were obtained together with detailed base pressure distribution measurements at angles of attack from 0 to 60 deg. The measured lift and drag coefficients showed good agreement with the modified Newtonian theory. The centerline base pressure/free stream static pressure, psia distribution was nearly independent of the angle of attack from -10 to -30 deg but increased rapidly for all test conditions beyond alpha = -30 deg. For similar conditions at angle of attack and Reynolds number, an increase in Mach number resulted in an increase of the base pressure ratio. The measurements indicated a higly complex base flow region, and tentative explanation of the observed results was offered. Author (GRA)

N76-15417# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

STABILITY AND MIXING OF SUBMERGED TURBULENT JETS AT LOW REYNOLDS NUMBERS Final Report

Christopher D. Ungate, R. F. Harleman, and Gerhard H. Jirka Feb. 1975 86 p refs Sponsored by New Engl. Elec. System and Northeast Utilities Serv. Co.

(PB-244178/0; MIT-EL-75-014) Avail: NTIS HC $5.00 CSCL 20D

Multiport diffusers were used to discharge heated cooling water from power plants into natural bodies of water in order to satisfy thermal discharge criteria by inducing dilution of the discharge. An experimental study was made of the variation of volume and centerline dilution as a function of Reynolds number in nonbuoyant and buoyant round jets discharged vertically from a submerged nozzle. Measurements of jet temperature profiles were obtained by using both fast and slow thermistor probes. The results are useful in determining the minimum length scale ratio for hydro-thermal model studies, especially those of submerged multiport diffusers. GRA

N76-15418# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

INVESTIGATION OF SELF-INDUCED BLOWING AND SUCTION ACROSS A REGION OF SHOCK WAVE-BOUNDARY LAYER INTERACTION Interim Report, Mar.-May 1975

James R. Cooper and Robert H. Korkegi Jun. 1975 16 p

(AF Proj. 7064)

(AD-A014247; ARL-75-0181) Avail: NTIS CSCL 20/4

Self-induced blowing and suction were used in an attempt to reduce the separated region of a shock-boundary layer interaction. High pressure air was channeled from the downstream side of the separated bubble to the low pressure boundary layer upstream of the interaction. Data obtained from the configurations tested in this study showed no improvement over the plain wall separation case. Author (GRA)

N76-15419# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

SEPARATED FLOW STUDIES Final Report, 1964-1974

W. L. Hankey Jun. 1975 14 p refs

(AF Proj. 7064)

(AD-A014245; ARL-75-0173) Avail: NTIS CSCL 20/4

This report reviews the progress over the last decade on separated flows conducted at these laboratories. Experimental investigations conducted in the hypersonic wind tunnels is discussed. Advancements are summarized in the theoretical area which cover the development of interacting boundary layers to the numerical computation of the complete Navier-Stokes equations. GRA

N76-15420*# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

TWO-DIMENSIONAL COMPRESSION CORNER AND PLANAR SHOCK WAVE INTERACTIONS WITH A SUPERSONIC TURBULENT BOUNDARY LAYER Final Report, Aug. 1972 - Feb. 1975

C. Herbert Law Jun. 1975 118 p refs

(AF Proj. 7064)

(AD-A014243; ARL-75-0157) Avail: NTIS CSCL 20/4

Experimental data have been obtained to describe the interactions between a turbulent boundary layer and (1) a two-dimensional compression corner and (2) an externally generated planar shock wave. Investigation were conducted at Mach number 3 over a range of Reynolds number from 10 to 100 million under adiabatic wall conditions. The effects of compression corner angle, planar shock wave strength, and Reynolds number on the length of separation and upstream inxluence were obtained. The incipient separation and upstream influence were obtained. The incipient separation cond and three-dimensional effects were also investigated. The separation and upstream influence lengths were found to increase with increasing Reynolds number for fixed overall pressure rise. The overall pressure rise for incipient separation is approximately the same for the compression corner interaction and the planar shock wave interaction, and increases with increasing Reynolds number. Turbulent boundary layer separation was found to be of the free interaction type, whereby the separation angle and the pressure distribution through separation were found to be independent of Reynolds number, overall pressure rise, and type of disturbance. For the case of the externally generated shock wave, the span of the shock generator had to be reduced in order to eliminate an initially significant influence of the sidewall shock wave-boundary layer interaction on the test region. Author (GRA)

N76-15421# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

EXPERIMENTS ON THE INTERACTION WITH A TURBULENT BOUNDARY LAYER OF A SKEWED SHOCK WAVE OF VARIABLE STRENGTH AT MACH 2.5 Final Report, Feb. 1973 - May 1975

L. Michael Freeman and Robert H. Korkegi Jun. 1975 26 p refs

(AF Proj. 7064)

(AD-A014246; ARL-75-0182) Avail: NTIS CSCL 20/4

This report covers an experimental study of the interaction of a skewed shock wave of variable strength with a turbulent boundary layer at a working Mach number of 2.5. The skewed shock wave was generated by a vertical wedge whose angle was varied in increments of 1 degree or less between 6 and 18 degrees in order to cover the spectrum of interaction from below incipient to widespread separation. Measurements include pressure distributions and oil flow photographs. The incipient separation angle was found to be between 71/2 and 8 degrees. For large wedge angles there is the appearance in the oil flow photographs of an inflection within the separated region, suggesting the possible approach to a secondary separation. The extent of separation is relatively small for angles up to 10 degrees, but grows more rapidly for larger angles. Author (GRA)

N76-15422# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Experimental Engineering Branch.

TIME RESOLVED ABSOLUTE INTENSITY MEASUREMENTS OF THE 5106 ANGSTROM COPPER ATOMIC SPECTRAL LINE IN THE AFFDL RENT FACILITY Interim Technical Report, Dec. 1972 - Feb. 1973

Jon B. Bader Jun. 1975 70 p refs

(AF Proj. 1426)

(AD-A014341; AFFDL-TR-75-33) Avail: NTIS CSCL 20/4

Spectral line intensity time histories of the copper spectral line at lambda equals 5106A were made while viewing from the side the gas cap region of blunt models under test in a Mach 1.8 contoured nozzle. These tests were performed in the Air Force Flight Dynamics Laboratory Re-Entry Nose Tip (RENT) Facility using arc heater stagnation pressures of 50, 75, 100, and 125 atmospheres, an arc heater current of 2600 amps, and a 0.9 in. throat diameter/1.1 in. exit diameter contoured nozzle. Similar measurements were also made at a wavelength corresponding to a nearby continuum region. Measurements were made with the field of view terminating on the hot model nose tips. Both short bursts of high frequency response data and continuous, moderate frequency response data were taken. Based on the above measurements, the response time and dynamic range required to follow the copper line intensity fluctuations in the model gas cap region were determined. From the absolute intensity of the 5106A copper line, effects of self-absorption on a line intensity ratio temperature measurement are discussed. GRA

N76-15423# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INFLUENCE OF REYNOLDS NUMBER ON THE NORMAL-FORCE CHARACTERISTICS OF SLENDER CYLINDRICAL BODIES

Helmut Esch 22 Jul. 1975 72 p refs Transl. into ENGLISH of report from Deutsche Luft- und Raumfahrt, West Germany, no. 9, 1975

(AD-A014400; FTD-ID(RS)I-1539-75) Avail: NTIS CSCL 20/4

Measurements have been made of the normal force and center of pressure of cylindrical bodies of revolution with ogival noses at Mach numbers from 0.5 to 4.0, and at angles of attack up to 25 degrees to investigate the influence of the boundary layer on the normal force characteristics of slender bodies. The Reynolds numbers based on model diameter varied between 150,000 and 5,000,000. By changing the stagnation pressure of the wind tunnel and by changing the scale of the models the Reynolds number at a given Mach number could be varied by a factor of about 8. In addition, the tripping of the boundary layer was studied. The experimental data are compared with results of computational methods. GRA

N76-15424# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH POWER ARC HEATERS AND EXPANSION NOZZLES FOR HIGH ENTHALPY FLOW INVESTIGATIONS

Martin Fiebig, Knud Kindler, and Demetrius G. Papanikas 6 Aug. 1975 49 p refs Transl. into ENGLISH of report from Deutsche Luft- und Raumfahrt, Munich, no. 6, 1972 p 1-72

(AD-A014313; FTD-ID(RS)I-1655-75) Avail: NTIS CSCL 20/4

The construction of flexible conical nozzles as aids in the aerodynamic measurement of high enthalpy flows is discussed. Particular attention was given to flows produced by hypersonic and space flight. In addition, high enthalpy flows for gasdynamic lasers were discussed. A description is given of the test facility. E.H.W.

N76-15425# Bell Aerospace Co., Buffalo, N.Y.

MASS ENTRAINMENT BY HYPERMIXING JETS Final Technical Report, Mar. 1974 - Jan. 1975

Wright-Patterson AFB, Ohio ARL Jun. 1975 95 p refs

(Contract F33615-74-C-4080; AF Proj. 7116)

(AD-A014396; Rept-9230-920001; ARL-75-0132) Avail: NTIS CSCL 20/4

An experimental investigation has been conducted to evaluate the mass entrainment characteristics of seven hypermixing nozzles, one rectangular convergent nozzle, and one circular convergent nozzle, over the primary to ambient pressure ratio range of 1.52 to 2.43. Four of the hypermixing nozzles had an exit angle of 45 degrees and individual element aspect ratios of 12, 8, 6, and 4. The remaining three, which all had individual element aspect ratios of 6, had nozzle exit angles of 30, 60, and 75 degrees. The rectangular nozzle aspect ratio was 48. Mass entrainment characteristics were measured for each nozzle at five pressure ratios and four downstream locations. GRA

N76-15426# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

AXIALLY SYMMETRIC TURBULENT BOUNDARY LAYERS ON CYLINDERS: MEAN VELOCITY PROFILES AND WALL PRESSURE FLUCTUATIONS

William W. Willmarth, Richard E. Winkel, Thomas J. Bogar, and Lalit K. Sharma Jun. 1975 140 p refs

(Contract N00014-67-A-0181-0015)

(AD-A014276; Rept-021490-3-T) Avail: NTIS CSCL 20/4

Experimental studies of the mean velocity profiles and of the wall pressure fluctuations within the axially symmetric turbulent boundary layer on cylinders of various diameters have been made. The measurements include the mean velocity and shear stress on cylinders with diameters ranging from 0.02 to 2.0 inches. A very small hot wire probe and simple anemometer circuit was developed and acoustically calibrated. The hot-wire measurements were used to determine the wall shear stress on the smallest diameter cylinders. A Preston tube was used to measure the shear stress on the larger cylinders. GRA

N76-15427# Stanford Univ., Calif. Thermosciences Div.

THE TURBULENT BOUNDARY LAYER: AN EXPERIMENTAL STUDY OF THE TRANSPORT OF MOMENTUM AND HEAT WITH THE EFFECT OF ROUGHNESS Interim Report

Marcos M. Pimenta, Robert J. Moffat, and William M. Kays May 1975 318 p refs

(Contract N00014-67-A-0112-0072; NR Proj. 094-368)

(AD-A014219; SU-HMT-21) Avail: NTIS CSCL 20/4

The turbulent boundary on a deterministic rough wall has been examined for the cases of isothermal and non-isothermal, zero pressure gradient flows with and without transpiration. The data include temperature and velocity profiles, turbulence intensity profiles, turbulence shear stresses and heat flux profiles and the correlation coefficients of both the fluid dynamic and temperature fields. GRA

N76-15428# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

[BUBBLE NUCLEATION IN SODIUM]

F. G. Hammitt Feb. 1975 15 p refs

(Grant NSF GK-1889)

(PB-244254/9; UMICH-01357-1-F) Avail: NTIS HC $3.50 CSCL 20D

This paper summarizes the study of bubble nucleation in sodium by both experimental and theoretical means. GRA

N76-15429# Michigan Univ., Ann Arbor. Gravitation and Multiphase Flow Lab.
WET STEAM FLOW STUDY Progress Report
F. G. Hammitt Mar. 1975 9 p refs
(Grant NSF GK-40130)
(PB-244255/6; UMICH-012449-1PR; PR-1) Avail: NTIS HC $3.50 CSCL 20D

Research on steam turbines is reported. Data cover: (1) the behavior of thin liquid films on stationary blading, deposited by the traversing wet steam flow in the low pressure end of modern large steam turbines (particularly in nuclear plants where the steam quality is especially low), which lead to a major erosion problem when shed droplets impact the next downstream moving blade row; and (2) the behavior of thin liquid films under high void fraction boiling conditions, where 'dry-out' problems become involved. This latter condition is typical of that which would exist if emergency cooling circuits of a liquid cooled reactor were activated after a loss of pressure accident. GRA

N76-15430# State Univ. of New York, Buffalo. Dept. of Civil Engineering.
FINITE ELEMENT MODELING OF FLOW THROUGH POROUS MEDIA Water Resources and Environmental Engineering Report, 15 Oct. 1972 - 1 Mar. 1975
Ralph Ta-shung Cheng Mar. 1975 93 p refs
(Contract DI-14-31-0001-9006)
(PB-243750/7; RR-75-2; W75-09900; OWRT-C-4026(9006)(4)) Avail: NTIS HC $5.00 CSCL 13B

Findings of an investigation into the application of the finite element method to ascertain ground water flow problems are presented. Reproductions of five articles from the published literature originating from the study and an appendix containing a computer subroutine package for solving the conventive-dispersion material balance equation using quadratic isoparametric finite elements are included. The published articles deal with the development of the basic theory for the finite element method as applied to ground water flow as well as basic schemes for application of the method. The results of the development are applied to the problem of sea water encraochment in coastal aquifiers, brine movement through causeways, and dispersion of pollutants in ground water flows. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-15431* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
COSMIC DUST ANALYZER Patent
Neal L. Roy, inventor (to NASA) (TRW Systems Group, Redondo Beach, Calif.) Issued 28 Oct. 1975 18 p Filed 31 May 1974 Supersedes N74-32883 (12 - 22, p 2694) Continuation-in-part of abandoned US Patent Appl. SN-189438, filed 14 Oct. 1971 Sponsored by NASA
(NASA-Case-MSC-13802-2; US-Patent-3,916,187; US-Patent-Appl-SN-475338; US-Patent-Class-250-251; US-Patent-Class-250-287; US-Patent-Class-250-423; US-Patent-Appl-SN-189438) Avail: US Patent Office CSCL 14B

The patent of an invention dealing with a cosmic dust analyzer was presented. Methods and apparatus are provided which employ ion time-of-flight techniques to determine the composition of a high velocity particle such as a micrometeorite. A charged target electrode formed of two known materials is arranged to intercept the particle, the impact of which creates a discrete plasma of ions of both the known target material as well as the particle matter. A charged collector electrode receives the ions from the target, which tend to travel at a velocity which is approximately a function of their mass only. The fractional ionization for an arbitrary atomic species can be specified by the Saha equation. Given the temperature, the procedure can be reversed to yield the relative abundance of elements in the impacting particle. Y.J.A.

N76-15432* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ULTRASONIC CALIBRATION DEVICE Patent
Joseph S. Heyman and James G. Miller, inventors (to NASA) Issued 9 Dec. 1975 4 p Filed 11 Nov. 1974 Supersedes N75-11248 (13 - 02, p 0162)
(NASA-Case-LAR-11435-1; US-Patent-3,924,444; US-Patent-Appl-SN-522556; US-Patent-Class-73-1R; US-Patent-Class-310-8.2) Avail: US Patent Office CSCL 14B

An ultrasonic calibration device for producing known changes in both acoustic absorption and phase velocity is described. The calibration signal arises from an actual change of acoustic parameters, not from an electrical simulation. Thus, changes in ultrasonic time-domain decay rates and frequency-domain line widths are produced. The device is able to simulate not only changes in ultrasonic absorption and phase velocity but also the sensitivity enhancement achieved by the use of ultrasonic resonators. Official Gazette of the U.S. Patent Office

N76-15433* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROMETEOROID VELOCITY AND TRAJECTORY ANALYZER Patent
Siegfried O. Auer, inventor (to NASA) (NAS-NRC) Issued 16 Dec. 1975 9 p Filed 30 Aug. 1974 Supersedes N74-32888 (12 - 22, p 2694) Sponsored by NASA
(NASA-Case-GSC-11892-1; US-Patent-3,927,324; US-Patent-Appl-SN-502135; US-Patent-Class-250-336; US-Patent-Class-250-385; US-Patent-Class-250-489) Avail: US Patent Office CSCL 14B

Movement of a charged particle through a region is detected by providing a detector including first, second and third spaced metal grids previous to the particle and positioned so that the particle passes through them in sequence. The first and third grids are short-circuited to each other and to ground. A signal input terminal of a d.c. amplifier is connected in d.c. circuit with the second grid so that a voltage pulse induced in the second grid by the particle passing through the three grids results in an output pulse of the amplifier. A plurality of such detectors are arranged for enabling the position and velocity vectors of the charged particle to be detected in three mutually orthogonal axes, X, Y and Z. Official Gazette of the U.S. Patent Office

N76-15434* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOCOUPLE TAPE Patent
Ralph D. Thomas, inventor (to NASA) Issued 9 Dec. 1975 5 p Filed 17 May 1972 Supersedes N72-28443 (10 - 19, p 2562) Division of US Patent Appl. SN-104885, filed 8 Jan. 1971, US-Patent-3,729,343
(NASA-Case-LEW-11072-2; US-Patent-3,925,104; US-Patent-Appl-SN-254323; US-Patent-Class-136-225; US-Patent-Class-136.211; US-Patent-Class-136-212; US-Patent-Appl-SN-104885; US-Patent-3,729,343) Avail: US Patent Office CSCL 14B

A thermocouple which may be rolled as a tape until needed and a method of making same are described. Thermoelectrically different metals are applied to a strip of electrically nonconductive material in longitudinally overlapping relationship. Apertures may be provided along the tape in the overlapping region at predetermined intervals. An adhesive material is applied to the side of the tape opposite the thermoelectric metals either before or after the thermoelectric metals are deposited. The tapes may be cut or torn to form a thermocouple device which is ready for application to a body whose temperature is to be monitored or measured. Official Gazette of the U.S. Patent Office

N76-15435* National Aeronautics and Space Administration. Pasadena Office, Calif.
DICHROIC PLATE Patent
Philip D. Potter, inventor (to NASA) (JPL) Issued 2 Dec. 1975 5 p Filed 27 Jun. 1974 Supersedes N74-27690 (12 - 17,

p 2014) Sponsored by NASA
(NASA-Case-NPO-13506-1; US-Patent-3,924,239;
US-Patent-Appl-SN-483851; US-Patent-Class-343-909) Avail: US Patent Office CSCL 14B

A dichroic plate is disclosed for passing radiation within a particular frequency band and reflecting radiation outside of that frequency band. The value of the thickness of the plate is selected so that the plate acts as a resonant narrow band pass filter for the desired pass frequency, and the shapes of the apertures in the dichroic plate are selected to compensate for the phase shift caused by the air-plate interface presented to the signals passing therethrough. Official Gazette of the U.S. Patent Office

N76-15436* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATOMIC STANDARD WITH VARIABLE STORAGE VOLUME Patent
Harry E. Peters, inventor (to NASA) Issued 2 Dec. 1975 5 p Filed 3 Oct. 1974 Supersedes N74-33997 (12 - 23, p 2838)
(NASA-Case-GSC-11895-1; US-Patent-3,924,200;
US-Patent-Appl-SN-511887; US-Patent-Class-331-94;
US-Patent-Class-331-3) Avail: US Patent Office CSCL 14B

A cylindrical, convoluted, flexible bellows is used to form an atomic or molecular storage vessel with constant surface area and surface properties but adjustable volume. When utilized as a storage bulb inside an atomic or molecular frequency standard such as a hydrogen maser, it provides an apparatus for obtaining an extremely accurate measurement of the frequency deviation caused by the interaction of gas atoms (or molecules) with the vessel wall surface.
Official Gazette of the U.S. Patent Office

N76-15437*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
THE NEW GL5115 GAS-ANALYZING GALVANIC DETECTOR FOR MICROCONCENTRATIONS OF OXYGEN
Kh. I. Agranov, Ye. T. Alitovskiy, and V. A. Maydanskiy Washington NASA Jan. 1976 8 p refs Transl. into ENGLISH from Prib. Sist. Upr. (USSR), v. 8, 1973 p 40-41
(Contract NASw-2789)
(NASA-TT-F-16677) Avail: NTIS HC $3.50 CSCL 14B

The purpose of the GL5115 is to satisfy the growing requirements in sensitivity, accuracy, reliability, and uniformity of output signals. The GL5115 determines the volumetric oxygen microconcentrations in nitrogen, ethylene hydrogen, helium and other gases. Its operation is based on an electrochemical reaction, occurring in a galvanic cell when a gaseous mixture containing oxygen passes through the cell. The electrochemical reaction is accompained by the emergence of a current, whose magnitude is proportional to the oxygen content. Author

N76-15438*# South Alabama Univ., Mobile.
LASER DOPPLER SPECTROMETER METHOD OF PARTICLE SIZING Final Report, 15 Jun. 1974 - 15 Jan. 1976
F. Neff Weber 15 Jan. 1976 18 p refs
(Grant NsG-3003)
Avail: NTIS HC $3.50 CSCL 14B

A spectrometer for the detection of airborne particulate pollution in the submicron size range is described. In this device, airborne particles are accelerated through a supersonic nozzle, with different sizes achieving different velocities in the gas flow. Information about the velocities of the accelerated particles is obtained with a laser-heterodyne optical system through the Doppler shift of light scattered from the particles. Detection is accomplished by means of a photomultiplier. Nozzle design and signal processing techniques are also discussed.
Author

N76-15439# Aeronautical Research Inst. of Sweden, Stockholm.
SOME ASPECTS OF STRAIN GAUGE QUALITY
Bjoern Bergqvist and Goesta Scherling Sep. 1974 34 p refs Presented at the Ann. Conf. of the Brit. Soc. for Strain Meas., Coventry, Engl., 19 Sep. 1974
(FFA-101) Avail: NTIS HC $4.00

The strain gage quality concept is discussed from the user's point of view, and from the aspect of manufacturing. Numerical values of several quantities which define the quality of a specified strain gage assembly were determined in the FFA strain gage laboratory, the measurement uncertainties of which are listed. Values determined for some quantities are shown such as: (1) long-term change of gage factor, (2) gage factor dependence on adhesive type, (3) thermal zero drift, (4) instantaneous gage factor dependence on temperature, and (5) cross sensitivity. Photographs of equipment used to test strain gages (extensometers) are shown. Strain gage fabrication advances are also examined. Author

N76-15440*# Technicolor Graphic Services, Inc., Houston, Tex.
IMAGE DEGRADATION IN AERIAL IMAGERY DUPLICATES
Harold E. Lockwood Sep. 1975 47 p
(Contract NAS9-11500)
(NASA-CR-144649) Avail: NTIS HC $4.00 CSCL 14E

A series of Earth Resources Aircraft Program data flights were made over an aerial test range in Arizona for the evaluation of large cameras. Specifically, both medium altitude and high altitude flights were made to test and evaluate a series of color as well as black-and-white films. Image degradation, inherent in duplication processing, was studied. Resolution losses resulting from resolution characteristics of the film types are given. Color duplicates, in general, are shown to be degraded more than black-and-white films because of the limitations imposed by available aerial color duplicating stock. Results indicate that a greater resolution loss may be expected when the original has higher resolution. Photographs of the duplications are shown.
J.R.T.

N76-15441# Unilever Research, Vlaardingen (Netherlands).
GAS DENSITY BALANCE VS. FLAME IONIZATION DETECTOR
P. VanDerPlank [1974] 8 p refs Submitted for publication
Avail: NTIS HC $3.50

Comments are made on a paper by Lanser et al. comparing the flame ionization detector with the gas density balance for quantitative GLC analysis of a mixture of aldehydes and aldehydic esters. Author (ESA)

N76-15442# European Space Agency, Paris (France).
THEORETICAL AND PRACTICAL INVESTIGATIONS FOR THE EVALUATION OF SATELLITE PHOTOGRAPHS ACCORDING TO THE PHOTOGRAMMETRIC METHOD
Ulrich Brokof Oct. 1975 157 p refs Transl. into ENGLISH of "Theoretische u. prakt. Untersuch. zur Auswertung von Satellitenaufnahmen nach der photogrammetrischen Methode", DFVLR, Brunswick Report DLR-FB-75-16, 2 Jan. 1975 Original German report available from DFVLR, Porz, West Ger. 60.40 DM
(ESA-TT-196; DLR-FB-75-16) Avail: NTIS HC $6.75

For satellite photograph evaluation, plate coordinates of star points and satellite points, which are measured in date sets, have to be transformed in a common reference system. The procedure which is used in practice was compared with a more universal method (free net). A further investigation was made with the parameters of the photogrammetric reduction model. According to the model by H.H. Schmid, a weight matrix is used for the parameters. Thus the algorithm for adjustment of indirect observations is distorted. The effect of this distortion was investigated. The evaluation procedure, as developed for the reduction of satellite photographs, is described briefly. An investigation into the effect of the orientation model on the satellite directions is discussed. The reduction results of 50 satellite photographs are analyzed. ESA

N76-15443# Naval Ordnance Lab., White Oak, Md.
A HYDRAULIC INCLINOMETER, LINEAR ACCELEROMETER AND ANGULAR ACCELEROMETER Final Report
W. P. Christoph 16 Dec. 1974 69 p
(AD-A013594; NOLTR-74-196) Avail: NTIS CSCL 14/2

An inclinometer, a linear accelerometer and an angular accelerometer are described. All devices utilize fluid as masses, the resiliency of bellows as restoring force and the fluid's viscosity for damping and hydraulic resistance. All devices use a pair of thermistor beads in a Wheatstone bridge as sensing elements for small fluid displacements. The generation of the required functions is dependent on the usage and/or design of the three devices above. Appendix A, by L. A. Vendetti, is a description of the electronic circuitry associated with the thermistor bridge.

In Appendix B, A. G. Rozner investigated the applicability of the new device for motion measurements of moored cylindrical bodies; and in Appendix C, the applicability of the new devices for the measurement of forces acting on a moored body. Author (GRA)

N76-15444# National Bureau of Standards, Washington, D.C.
NBS INTERAGENCY TRANSDUCER PROJECT Progress Report, 1 Oct. - 31 Dec. 1974
Paul S. Lederer, John S. Hilten, and Carol F. Vezzetti 27 Jun. 1975 24 p Sponsored in part by Range Commanders Council, Albuquerque, N. Mex.
(COM-75-11022/1; NBSIR-75-732) Avail: NTIS HC $3.50 CSCL 14B

The continuing development of a test method for evaluating the effects of short-duration thermal radiant-energy transients on pressure transducer performance is described. The method consists of monitoring pressure transducer output as the transducer is exposed to radiation resulting from the ignition of a photographic flashbulb or from the discharge of an electronic flash. Precision of the method is to be at least adequate for the method to serve as a first-cut screening test. During this reporting period, the following three parameters were investigated for each of three radiation sources: (1) the amount of energy per unit area available as a function of distance from the source, (2) the response of a selected transducer as a function of distance from the source, and (3) flash duration. GRA

N76-15445# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
PIEZOELECTRIC POLYMER TRANSDUCER FOR IMPACT PRESSURE MEASUREMENT Final Report, 15 Dec. 1973 - 31 Dec. 1974
Aime S. DeReggi Jul. 1975 40 p refs
(Contract DOT-HS-4-00835)
(COM-75-11127/8; NBSIR-75-740) Avail: NTIS HC $4.00 CSCL 14B

Described are development efforts relating to the design, construction, and calibration of a piezoelectric polymer transducer for the recording of pressure transients developed over the interface between two bodies as a result of impact. A bilaminate design was selected which uses electrically poled sheets of 25 micrometer poly(vinylidene fluoride) as the active material. The intended primary response of the transducer is to compression in the thickness direction, which is produced by either hydrostatic or normal pressure; the transducer was also found to respond to extension in the membrane direction. GRA

N76-15446# Tamarack Scientific Co., Inc., Orange, Calif.
TRANSIENT CALORIMETER CALIBRATION SYSTEM Final Report, 1 Mar. 1973 - 1 Feb. 1974
R. E. Sheets and R. L. Pierce Mar. 1975 57 p refs
(Contract F33615-73-C-3045; AF Proj. 1426)
(AD-A014365; AFFDL-TR-75-24) Avail: NTIS CSCL 14/2

Null point calorimeters are used to measure heat flux levels in excess of 15.0 kW/per sq cm in arc heated re-entry wind tunnels. To augment these measurements at the Air Force Flight Dynamics Laboratory a calibration system and a transfer standard was developed. The system generates heat flux densities up to 10 kW/per sq cm within a 0.25 in. square target zone using a xenon arc radiation source. The absorptivity of calorimeter surfaces to this radiant source is measured with an accessory apparatus to yield a calibration accuracy of 5%. GRA

N76-15447# Northwestern Univ., Evanston, Ill.
THE APPLICATION OF A POSITION-SENSITIVE X-RAY DETECTOR TO THE MEASUREMENT OF RESIDUAL STRESSES
M. R. James and J. B. Cohen 1 Aug. 1975 18 p refs
(Contract N00014-75-C-0580; NR Proj. 5345-455)
(AD-A014483; TR-11) Avail: NTIS CSCL 14/2

In recent years considerable success has been achieved in the development of detectors for the localization of ionizing radiation. One dimensional position sensitive detectors have a number of uses in nuclear physics and in biological studies using small-angle scattering. Detectors are now capable of providing position information of high resolution with a high count rate capability and a simple read-out system. The authors report on the feasibility of employing a position sensitive proportional counter (PSPC) for the measurement of residual stresses with X-rays. The ability of obtaining the entire profile at once is somewhat offset by the lower efficiency of the PSPC when compared to a scintiallation detector, but this is counteracted by the fact that motion of the detector is eliminated with the PSPC. It will be shown that a PSPC system provides a speed of data accumulation currently not available in any other way, while still remaining a versatile and accurate method. GRA

N76-15448# Hughes Research Labs., Malibu, Calif.
FORMATION OF SCENE ANALYSIS PLANS USING PATTERN REPLACEMENT FOR REGION STRUCTURE ANALYSIS Interim Scientific Report, 1 Apr. 1974 - 31 Mar. 1975
Bruce L. Bullock May 1975 36 p
(Contract F44620-74-C-0054; AF Proj. 9769)
(AD-A014303; AFOSR-75-1030TR) Avail: NTIS CSCL 17/8

The work in this research program is concerned with developing technology to derive useful information from real world scenes. The results from this research can be applied to imagery related problems such as reconnaissance, surveillance, and guidance. The specific objective of the 1974 program was to develop the language, sensing and analysis techniques for planning low level analysis of scenes. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-15449 Purdue Univ., Lafayette, Ind.
THE DESIGN AND OPERATION OF A HIGH FREQUENCY BURST SIGNAL PROCESSOR FOR LASER DOPPLER VELOCIMETER APPLICATIONS Ph.D. Thesis
Ronald Edgar Zammit 1975 120 p
Avail: Univ. Microfilms Order No. 75-606

Design, development, and application are reported of a digital electronic processor for measuring the frequency of the burst signals produced by laser velocimeters of the differential Doppler type. The processor employs precision time to amplitude converters rather than a digital clock to determine the period of the Doppler signal, resulting in a frequency measurement accuracy of better than one percent over the entire range. Both the original processor and a second prototype have been used in conjunction with a two-wavelength laser Doppler velocimeter for measurements of laminar and turbulent supersonic flows. The data obtained agree well with that taken by other instruments. Dissert. Abstr.

N76-15450*# Princeton Univ., N.J.
A SEARCH FOR CHEMICAL LASER ACTION IN LOW PRESSURE METAL VAPOR FLAMES Ph.D. Thesis
Melvin L. Zwillenberg Sep. 1975 403 p Sponsored in part by NSF
(Grants NGR-31-001-129; NGR-31-001-312)
(NASA-CR-146083; Rept-1214-T) Avail: NTIS HC$11.00 CSCL 20E

Optical emissions were studied from low pressure (approximately 1 torr) dilute diffusion flames of Ca and Mg vapor with O2, N2O and mixtures of CCl4 and O2. The Ca flames with O2 and N2O revealed high vibrational excitation of the product CaO molecule (up to v=30). The flames with CCl4 revealed extreme nonequilibrium metal atom electronic excitation, up to the metal atom ionization limit (6.1 eV for Ca, 7.6 eV for Mg). The metal atom excited electronic state populations did not follow a Boltzmann distribution, but the excitation rates ('pumping rate') were found to obey an Arrhenius-type expression, with the electronic excitation energy playing the role of activation energy and a temperature of about 5000 K for triplet excited states and 2500 K for singlets (vs. approximately 500 K translational temperature). Author

N76-15451*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR SPLITTING A BEAM OF ENERGY Patent Application
Walter Robert Leeb, inventor (to NASA) (NAS-NRC) Filed 23 Dec.

1975 35 p
(Contract NASw-2567)
(NASA-Case-GSC-12083-1; US-Patent-Appl-SN-643897) Avail: NTIS HC $4.00 CSCL 20E

An energy beam splitting is described that has a first surface for splitting an incident beam energy into an externally reflected beam and an internally transmitted beam, and a second surface spaced from the first surface for splitting the internally transmitted beam into an externally transmitted beam and into an internally reflected beam. The second surface intersects the first surface so that it impinges the internally transmitted beam on the second surface at an angle of incidence that is less than the minimum angle necessary for substantially total internal reflection. NASA

N76-15452# Air Force Weapons Lab., Kirtland AFB, N.Mex.
ANALYSIS OF A FLUID SUPPLY SYSTEM (FSS) Final Report, 1 Jan. - 31 Jul. 1974
Dean A. Schneider Aug. 1975 21 p
(AD-A014322; AFWL-TR-74-261) Avail: NTIS CSCL 20/5

A model is described for the analysis of a fluid supply system for a gas dynamic laser to determine the pressure- and temperature-time history of the helium pressurant. The equations developed are coded into a computer program. Sample results are given. GRA

N76-15453# Oregon Graduate Center for Study and Research, Beaverton.
PROPAGATION OF MULTIWAVELENGTH LASER RADIATION THROUGH ATMOSPHERIC TURBULENCE Interim Technical Report, 1 Sep. 1974 - 31 Mar. 1975
J. Richard Kerr, James R. Dunphy, Richard A. Elliott, and Philip A. Pincus Griffiss AFB, N. Y. RADC Jul. 1975 51 p refs
(Contract F30602-74-C-0082; ARPA Order 1279)
(AD-A014433; RADC-TR-75-181) Avail: NTIS CSCL 20/6

This report describes recent progress and ongoing efforts on several topics in optical propagation through atmospheric turbulence. In Section II are described some further results on the short-term statistics of turbulence and scintillation, which supplement the detailed treatment given in the preceding report on this program. In Section III, the authors discuss a new topic, the conditional fading statistics of a scintillating signal or target illumination, in which the state of the 'channel' is investigated immediately following the onset of a 'good' interval. Finally, in Section IV the authors describe new experimental work and facilities, including multiwavelength target-irradiance investigations with beam-wander cancelling tracker very-long-path or strong-scattering scintillation phenomena, and other areas of interest. GRA

N76-15454# Transportation Systems Center, Cambridge, Mass.
THE DEVELOPMENT OF AN EXPERIMENTAL AIRBORNE LASER REMOTE SENSOR FOR OIL DETECTION AND CLASSIFICATION IN SPILLS Final Report
John F. Fantasia and Hector C. Ingrao Feb. 1975 165 p refs
(Contract DOT-PPA-CG-03)
(AD-A013580; TSC-USCG-74-5; USCG-D-86-75) Avail: NTIS CSCL 14/2

A study and measurements program to determine the feasibility of using laser-excited oil fluorescence as a means of detecting and classifying oils in spills in the marine environment was undertaken at the DOT/Transportation Systems Center. The study consisted of an analysis of the fluorescence properties of oils and oil slicks on the sea surface, and a theoretical analysis of the remote fluorometry of oil spills. As a result of this study a laboratory and field measurements program was undertaken. Laboratory measurements were made of 29 crude and refined oils commonly transported in the marine environment. These measurements included API gravity, fluorescence and reflectance spectra, fluorescence coefficient and fluorescence lifetimes. Similar measurements were made with a laboratory model of an N2 laser oil spill remote sensor. Results of these measurements showed that, under certain conditions, oil spill detection and classification can be made in the marine environment. GRA

N76-15455# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
EDL PERFORMANCE MODEL. PART 1: THEORY AND USER'S GUIDE Final Report, 13 Sep. 1974 - 30 Jun. 1975
Juergen Thoenes, Shelby C. Kurzius, and Marcus L. Pearson Jun. 1975 125 p refs
(Contract DAAH03-75-C-0077)
(AD-A014355; LMSC-HREC-TR-D390777-Pt-1; RG-CR-75-2-Pt-1) Avail: NTIS CSCL 20/5

A computer model has been developed to evaluate the thermophysical characteristics of an electron-beam sustained electric discharge excited continuously flowing CO2 laser. The model includes a detailed treatment of the cavity flow field, finite rate excitation-relaxation kinetics, electron-beam sustained discharge, and stable or unstable resonator optical cavity. The flow model is based on a finite-difference solution of boundary layer type conservation equations, treating either laminar or turbulent flows. Wave propagation is treated with a two-dimensional Fresnel Integral allowing the waves(s) to interact with the flowing gain medium. The result is a consistent, fully coupled theoretical model for continuous wave electron-beam sustained electric discharge lasers. GRA

N76-15456# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL INVESTIGATION OF THE STARTING PROCESS OF SHORT DIFFUSERS FOR GAS DYNAMIC LASERS M.S. Thesis
Milford Merwin Oudekerk Jun. 1975 61 p refs
(AD-A014556) Avail: NTIS CSCL 20/5

The diffuser section of a Gas Dynamic Laser (GDL) is one of the largest components in the system. The purpose of this investigation was to examine the problem of starting supersonic flow in short diffusers with fixed walls, incorporating various bleed arrangements for boundary layer control (BLC). A Mach number of 4, ramp angle of 19 degrees diffuser length of 4.5 inches and a diffuser width of 1.0 inch were used throughout this investigation. Intrusion by the atmosphere into the diffuser causes a separation region or bubble to form. The presence of this 'bubble' could be made to improve the diffuser performance by making a variable area diffuser out of a fixed wall diffuser without the use of any external apparatus. BLC was helpful in increasing the over all pressure recovery of the diffuser. BLC also affects the unsteady flow, which was present in the diffuser, but only when it is applied at a point prior to the converging section of the GDL. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-15457* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REMOTELY OPERABLE ARTICULATED MANIPULATOR Patent
Ray E. Marlow, inventor (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Issued 2 Dec. 1975 8 p Filed 23 Dec. 1974 Supersedes N75-14131 (13 - 05, p 0537) Sponsored by NASA
(NASA-Case-MFS-22707-1; US-Patent-3,922,930; US-Patent-Appl-SN-535410; US-Patent-Class-74-665B; US-Patent-Class-74-384; US-Patent-Class-214-1R) Avail: US Patent Office CSCL 13I

An improved, remotely operable, articulated manipulator is described which includes a plurality of serially connected drive shafts and a grasping device mounted at the distal end of the ultimate drive shaft of a plurality of drive shafts. A plurality of joints includes meshed bevel gears interconnecting the drive shafts, whereby rotary motion is imparted to the grasping device in response to rotation imparted to the drive shafts. Drive tubes concentrically related to the drive shafts impart angular displacement to the drive shafts about axes normally related to the longitudinal axes. A differential includes a multiplicity of driver inputs for selectively rotating the drive shafts and drive tubes about their longitudinal axis.
Official Gazette of the U.S. Patent Office

N76-15458 Polish Academy of Sciences, Warsaw.
INVESTIGATIONS OF WEAR IN GEAR TRAINS [BADANIA ZUZYCIA W PRZEKLADNIACH ZEBATYCH]

Jan Dekert 19 Jun. 1975 15 p refs In POLISH
Avail: Issuing Activity

Wear phenomena in cylindrical gears with helical teeth and parallel axes were investigated. Topics discussed include slip velocity and rolling in the tooth contact zone, temperature and pressure distribution in the contact zone, and fatigue test investigations. Transl. by M.J.S.

N76-15459 Polish Academy of Sciences, Warsaw.
GENERALIZED MODEL OF A ROTOR ON FLEXIBLE SUPPORTS [UOGOLNIONY MODEL WIRNIKA NA PODATNYCH PODPORACH]
Agnieska Muszynska 7 Jun. 1975 29 p refs In POLISH
Avail: Issuing Activity

A physical and mathematical model is described of a single-piece rotor (with a disk mounted on the shaft) spinning on two massive sliding bearings. The bearings are located on anisotropic, flexible supports. A numerical analysis is presented which includes equations of motion, equilibrium equations, hydrodynamic equations, and matrices. Transl. by M.J.S.

N76-15460* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REMOTE MANIPULATOR SYSTEM Patent
Donald A. Kugath (GE, Schenectady, N. Y.), Dan H. Dane (GE, Schenectady, N. Y.), and Herman T. Blaise, inventors (to NASA) (GE, Schenectady, N. Y.) Issued 2 Dec. 1975 6 p Filed 11 Oct. 1973 Supersedes N74-10099 (12 - 01, p 0013) Sponsored by NASA
(NASA-Case-MFS-22022-1; US-Patent-3,923,166; US-Patent-Appl-SN-405341; US-Patent-Class-214-ICM) Avail: US Patent Office CSCL 13I

A master-slave manipulator system is described which has two master units controlled by the two arms and hands of an operator and two corresponding slave units. Both the master and the slave units have a first arm rotably mounted to the floor at 30 deg from the vertical, a second arm pivoted to it and mounted for rotation, and a third arm pivoted to the second arm. The slave has a pivotally and rotatably mounted gripper unit with manual master has a pivotally mounted gripper unit with manual switch controls. The servomechanism system includes a solid-state control circuit, and flat, helically wound, internal ribbons of wires.
Official Gazette of the U.S. Patent Office

N76-15461* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLUID JOURNAL BEARINGS Patent
Frederick T. Schuller and Warren A. Moore, inventors (to NASA) Issued 16 Dec. 1975 4 p Filed 25 Feb. 1974 Supersedes N74-18134 (12 - 09, p 1055) Division of US Patent Appl. SN-346483, filed 30 Mar. 1973, US-Patent-3,830,552, which is a Division of US Patent Appl. SN-238264, filed 27 Mar. 1972, US-Patent-3,804,472
(NASA-Case-LEW-11076-4; US-Patent-3,926,482; US-Patent-Appl-SN-445178; US-Patent-Class-308-9; US-Patent-Class-308-72; US-Patent-Class-308-73; US-Patent-Class-308-122; US-Patent-Class-308-160; US-Patent-Appl-SN-346483; US-Patent-3,830,552; US-Patent-Appl-SN-238264; US-Patent-3,804,472) Avail: US Patent Office CSCL 13T

A plurality of bearing sectors are mounted on a housing. The sectors function as lobed areas in the bearing to obtain the required lubricant film geometry. Each sector has a pad flexibly mounted on a base with a thin neck which forms a pivot.
Official Gazette of the U.S. Patent Office

N76-15462*# Endevco, San Juan Capistrano, Calif.
A STUDY OF THE USE OF VIBRATION AND STRESS WAVE SENSING FOR THE DETECTION OF BEARING FAILURE
L. C. Ensor and C. C. Feng 30 Sep. 1975 156 p refs
(Contract NAS8-29916)
(NASA-CR-144130; ER-75-18-C) Avail: NTIS HC $6.75 CSCL 13I

Results from an experimental study of vibrations and stress waves emitted from ball bearings are presented. Fatique tests were run with both high quality bearings and man faulted bearings, all of one size. Tests were instrumented with different sensors to detect the noises from 10 Hz to 1 MHz. Frequency spectrum plots are presented. The modulation characteristics of the ultrasonic noises were analyzed, and acoustic emission type measurements were conducted. Results are presented which show that there are usable acoustic signal levels even beyond 500 KHz. These signal levels are modulated by a low frequency carrier which is a function of the stress loading and acoustic transmissibility. The results were correlated to fault size in the bearings. The correlation shows that the sensor used for signals from 100 KHz to 1 MHz gave the best sensitivity and detected the generation of very small spalls or pits. Author

N76-15463*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LOAD REGULATING LATCH Patent Application
Walter T. Appleberry, inventor (to NASA) (Rockwell Intern. Corp., Downey, Calif.) Filed 18 Dec. 1975 20 p
(Contract NAS9-14000)
(NASA-Case-MSC-19535-1; US-Patent-Appl-SN-641784) Avail: NTIS HC $3.50 CSCL 13E

A load regulating mechanical latch is reported that has a pivotally mounted latch element with a hook shaped end and a strike roller engaging laterally open hook for engaging a stationary strike roller. The latch element or hook is pivotally mounted in a clevis end of an elongated latch stem that is adapted for axial movement through an opening in a support plate or bracket mounted to a structural member. A coil spring is disposed over and around the extending latch stem and the lower end of the coil spring engages the support bracket. A thrust washer is removably attached to the other end of the latch stem and engages the other end of the coil spring and compresses the coil spring thereby preloading the spring and the latch element carried by the latch stem. NASA

N76-15464*# AiResearch Mfg. Co., Los Angeles, Calif.
OXYGEN BOOST PUMP STUDY Final Report, Apr. - Dec. 1975
Dec. 1975 40 p refs
(Contract NAS2-8794)
(NASA-CR-137787; AiResearch-75-12264) Avail: NTIS HC $4.00 CSCL 13K

An oxygen boost pump is described which can be used to charge the high pressure oxygen tank in the extravehicular activity equipment from spacecraft supply. The only interface with the spacecraft is the +06 6.205 Pa supply line. The breadboard study results and oxygen tank survey are summarized and the results of the flight-type prototype design and analysis are presented. Author

N76-15465# Hollandse Signaalapparaten N. V., Hengelo (Netherlands).
PRELIMINARY INVESTIGATION OF A MAGNETIC SEAL FOR A HYDRODYNAMIC BEARING
J. Hofman Apr. 1975 45 p
(Contract ESTEC-2281/74-PP)
(ESA-CR(P)-711) Avail: NTIS HC $4.00

The preliminary work described was carried out in order to demonstrate the feasibility and performance of a magnetic oil (ferrofluid) as substitute for grease in hydrodynamic bearings for momentum wheel applications and a separate magnetic seal in combination with a mercury O-ring and a thin silicon lubricant as substitute for the grease. A comparison was made with a grease lubricated hydrodynamic bearing to provide a basis for a decision to continue with the following phase. Work was carried out for the Orbital Test Satellite. ESA

N76-15466# National Bureau of Standards, Washington, D.C. Diffusion in Metals Data Center.
INTERDIFFUSION DURING THE PRESSURE WELDING OF LIGHT ALLOYS
L. A. Nilolskii and N. V. Ratova 1974 12 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 1, 1972 p 114-120 Sponsored in part by NSF
(TT-74-58005; DMDC-13975) Avail: NTIS HC $3.50

The interdiffusion occurring between aluminum alloys covered with layers of other aluminum-base alloys was investigated in the temperature range 440 to 480C. Both the substrate alloys as well as the protective coatings were aluminum-base and

contained varying amounts of copper, zinc, and magnesium. Interdiffusion coefficients were calculated for copper, zinc, and magnesium. Composition profiles were determined with an electron profile microanalyzer. Microhardness traverses were also made. The microstructure and width of the interdiffusion zone were followed closely. GRA

N76-15467# Henry (J. J.) Co., Inc., New York.
ENGINEERING DESIGN AND ECONOMIC STUDIES OF THE HEAVY-DUTY INDUSTRIAL GAS TURBINE IN A LIQUEFIED PETROLEUM GAS CARRIER Final Report
24 Jun. 1975 123 p
(Contract MA-5-38020)
(COM-75-11077/5; MA-RD-930-76-03) Avail: NTIS HC $5.50 CSCL 21E

This report presents the results of an engineering design and economic evaluation of the installation of a 24,000 SHP Heavy Duty Industrial Gas Turbine propulsion plant in a LPG Carrier under the terms of MA Contract 5-38020 between the Maritime Administration and J.J. Henry Co., Inc. The report provides Contract Plans and Specifications, and compares the operating costs and performance with those of a steam propulsion plant of equivalent power. The annual operating costs of the gas turbine are somewhat lower than those of the steam propulsion plant; however, the savings do not provide an unquestionable basis for selection. To be truly competitive, the gas turbine must have a lower fuel rate, and provide a means of reversing at lower cost. GRA

N76-15468# United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.
THE 3000-HP ROLLER GEAR TRANSMISSION DEVELOPMENT PROGRAM. VOLUME 3: ROLLER GEAR MANUFACTURE Final Report
G. F. Gardner and K. R. Cormier Jul. 1975 293 p refs
(Contract DAAJ02-69-C-0042; DA Proj. 1G1-62207-AA-72)
(AD-A014135; SER-50897-Vol-3;
USAAMRDL-TR-73-98C-Vol-3) Avail: NTIS CSCL 13/9

This report presents a survey of the manufacturing methods used in the production of the roller gear transmission. The bulk of the material contained herein deals with the roller gear components of the transmission because of the unique manufacturing problems they presented. No attempt is made to describe in detail the more conventional manufacturing processes employed in the program. The most significant aspect of the manufacture of the roller gear components was the extensive use of electron beam welding. This method of assembly was completely satisfactory with respect to holding critical dimensional tolerances; however, weld integrity, particularly in certain highly stressed joints, was a continual problem. Although weld joint design certainly contributed to the problems encountered, the presence of weld voids was certainly a major factor in the weld related fractures. GRA

N76-15469# United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.
THE 3000-HP ROLLER GEAR TRANSMISSION DEVELOPMENT PROGRAM. VOLUME 5: AIRCRAFT TIEDOWN TESTING Final Report
G. F. Gardner and D. O. Adams Jul. 1975 150 p refs
(Contract DAAJ02-69-C-0042; DA Proj. 1F1-62207-AA-72)
(AD-A014267; UTRC/S611653-Vol-5;
USAAMRDL-TR-73-98E-Vol-5) Avail: NTIS CSCL 13/9

This report presents the results of a helicopter tiedown test program. The primary purpose of this test was to evaluate a roller gear transmission in an aircraft installation and to conduct a 50-hour tiedown test at a power spectrum equivalent to helicopter military usage. The roller gear transmission transmits 3,000 hp at 203 rpm to a helicopter main rotor head. The transmission is powered by two General Electric axial-flow turboshaft engines, each producing 1,870 hp at 18,966 rpm. A 19.85:1 roller gear unit is the final reduction stage in the transmission. GRA

N76-15470# Scientific Research Associates, Inc., Rockville, Md.
THE DESIGN OF A CASCADE OF SHOULDER-TO-SHOULDER MECHANICAL ANTIRESONANCES
Albert A. Hudimac Jul. 1975 37 p refs
(Contract N00014-70-C-0378)
(AD-A014482; Rept-75-1) Avail: NTIS CSCL 13/9

A vibration isolation module can be made by the alternation of masses and springs to produce a low-pass filter. To decrease the cut-off frequency the masses can be replaced by a cascade of high-Q antiresonant units mounted axially in a cylindrical can. To achieve a high impedance over an appreciable bandwidth, the peaks of the individual response curves are made equal and the successive antiresonant frequencies are chosen to lie shoulder-to-shoulder. Details of a specific design and choice of parameters are presented, as well as the analytical basis. An experimental method for the determination of the viscous damping prior to assembly is described. GRA

N76-15471# Westinghouse Electric Corp., Cheswick, Pa. Electro-Mechanical Div.
DESIGN AND DEVELOPMENT OF A SEGMENTED MAGNET HOMOPOLAR TORQUE CONVERTER Semiannual Technical Report, period ending 31 May 1975
C. J. Mole, F. G. Arcella, E. Berkey, D. J. Boes, and V. B. Doshi Jul. 1975 170 p refs
(Contract DAHC15-72-C-0229; ARPA Order 2174)
(AD-A014503; EM-4705) Avail: NTIS CSCL 13/9

This program is for the research and development of a new mechanical power transmission concept: the segmented magnet homopolar torque converter. The purpose of this device is to convert unidirectional torque of constant speed (such as from a steam turbine prime mover) into variable speed output torque in either the forward or reverse directions. The concept offers an efficient, lightweight low volume design with potential application over a wide range of speeds and power ratings in the range from hundreds to tens of thousands of horsepower. This machine concept can be applied to commercial and military advanced concept vehicles for both terrain and marine environments. The program places particular emphasis on the technology of liquid metal current collection systems for the reason this is essential for the success of the homopolar machine concept. In Phase I the technical problems were reviewed, the machine concepts were studied, and a detailed technical plan was evolved for the entire program. In Phase II, theoretical, engineering, and experimental tasks were performed to develop a reliable constant speed current collection system which was demonstrated in an actual segmented magnet homopolar generator (SEGMAG). The objectives of Phase III are to extend the technology developed in Phase II for constant speed machines to the case of the torque converter which must operate at variable and reversing speeds. This report period encompasses a portion of the work performed during Phase III. Author (GRA)

N76-15472# Block Engineering, Inc., Cambridge, Mass.
ADVANCED HANDLING AND SORTING TECHNIQUES FOR ULTRASMALL PARTICLES Final Report
Stuart J. Hemple, H. John Caulfield, and Kalyan Dutta 15 Apr. 1975 125 p refs
(Contract F08606-73-C-0042; ARPA Order 1702)
(AD-A014590; BEI-75-649) Avail: NTIS CSCL 13/8

The goal of the particle handling project was to design and construct an automatic particle sorter. The instrument was to be capable of sorting out particles of interest rapidly and with low loss. The particle diameter range, over which this instrument was to be effective was 5 micrometers to 0.1 micrometer. The following techniques were investigated for use in a breadboard particle sorter: plasma ashing, dielectrophoresis, and one-at-a-time sorting. In addition, particle aerosolization by plasma ashing, gas dynamic transport and positioning of particles, and particle deposition from gas flow were studied to interface the three techniques. GRA

N76-15473# Rochester Univ., N.Y.
PROGRAM FOR SECOND RANN GRANTEES' CONFERENCE ON PRODUCTION RESEARCH AND INDUSTRIAL AUTOMATION
1 Jan. 1975 160 p refs Conf. held at Rochester, N. Y., 8-10 Jan. 1975 Sponsored by NSF
(PB-244287/9; NSF/RA/T-75-014) Avail: NTIS HC $6.75 CSCL 13H

The focus of this conference is advanced research and development in automation and production technologies, with

special reference to the discrete goods industries. Research and development in manufacturing and related areas is the subject of the papers presented the first day. Studies concerning assembly, material handling, and inspection were presented the second day. The final day was spent on postscript reports and impact studies. GRA

N76-15474# Army Foreign Science and Technology Center, Charlottesville, Va.
ENGINE WITH FUEL INJECTION AND PRECHAMBER-TORCH IGNITION
N. A. Kerimov 9 Sep. 1975 10 p refs Transl. into ENGLISH from Avtomob. Prom. (USSR), no. 8, 1967 p 8-11
(AD-A014531; FSTC-HT-23-1245-75) Avail: NTIS CSCL 21/7

The problem of designing a practical engine with torch ignition is discussed along with its connection with the problem of organizing fuel and air supply to the prechamber. A fuel feed system for implementing this method is discussed. M.J.S.

N76-15475# Brush Wellman, Inc., Elmore, Ohio.
PRODUCTION ENGINEERING MEASURES TO MANUFACTURE SUPER FINE FINISH BERYLLIA Quarterly Progress Report, 1 Apr. - 30 Jun. 1975
Glenn H. Rees 12 Aug. 1975 25 p
(Contract DAAB07-74-C-0606)
(AD-A014160; BW-TR-570; QPR-4) Avail: NTIS CSCL 11/2

The purpose of this program is to develop the production engineering measures to manufacture beryllia substrates of which the working surface shall not exceed a four microinch per inch surface smoothness by progressive polishing techniques. The input material will be commercially available beryllia, the composition of which shall not be less than 99.5% BeO. GRA

N76-15476# AutoResearch Labs., Inc., Chicago, Ill.
FUNDAMENTALS OF HYPOID GEAR LUBRICATION Final Summary Report, 2 Aug. 1970 - 30 Sep. 1974
Robert T. Weissmann Aug. 1975 187 p
(Contract DAAD05-70-C-0376)
(AD-A014107) Avail: NTIS CSCL 11/8

The CRC L-42 scoring test currently used under the Military Specification MIL-L-2105B has at times showed deficiencies in evaluating the scoring resistance of gear lubricants. The inadequacy of this test method led to the development of a test device and a procedure designed to evaluate the scoring resistance of gear lubricants more accurately. An account is given of the steps in the test development employing special test gears and the CRC reference oils. Data are presented on the precision and repeatability of the test for differentiating the scoring resistance of hypoid gear oils covering a range of performance levels from RGO 104 to RGO 115. An account is given on the development of special test gears for use in developing a test procedure to replace the CRC L-37 load carrying test in cooperation with the National Research Council of Canada. Cooperative efforts are described dealing with the study by the ASTM Research and Development Division VII of the low temperature performance of gear lubricants and with the CRC Oxidation Test Techniques Panel study of a revised Thermal Oxidation Stability Test procedure. Color illustrations reproduced in black and white. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-15477# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Satellitenelektronik.
HARDWARE FAILURE DIAGNOSIS
August Kurau and Heinz-Georg Tillmann (Tech. Univ., Munich) 18 Oct. 1974 81 p refs IN GERMAN; ENGLISH summary
(DLR-Mitt-74-41) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. DM 29,40

A complete overview of hardware failure diagnosis is given. The importance of treating error possibilities in both hardware and software of digital computers involved in industrial production and management is stressed. Theoretical assumptions and computations are outlined, error simulation models listed, and inbuilt error correcting devices and programs discussed. (ESA)

N76-15478# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
APPLIED RESEARCH STUDY ON EQUIPMENT RELIABILITY Final Report
26 May 1975 224 p refs
(Contract ESOC-650/74-AR)
(MBB-RO2-75/01; ESA-CR(P)-707) Avail: NTIS HC $7.75

Models were developed and input data requirements defined for the determination of actual equipment reliability in spacecraft ground stations from observed failures and times. An overall reliability evaluation model was developed which includes a Boolean system reliability model and confidence functions for the compatibility of an observed reliability function parameter with a value predicted or previously observed. Type and frequency of observations forming the database for reliability evaluation were determined. Desirable modifications to enhance reliability of equipment parameters were determined. Costs of computerizing the evaluation model were considered. The developed methods and solutions are applied to the Odenwald Meteosat ground station. ESA

N76-15479# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NONDESTRUCTIVE CONTROL OF MATERIALS BY ULTRASONIC TESTS Ph.D. Thesis - Paris Univ., 8 Nov. 1974
Noelle Mercier May 1975 103 p refs In FRENCH; ENGLISH summary Report will also be announced as translation
(ONERA-NT-232) Avail: NTIS HC $5.50

A bibliographic study of nondestructive control methods of solids by ultrasonic tests and of the ultrasonic emission of a transducer of finite dimension, is first presented. The principle of two of these methods is verified experimentally; they should permit the measurement of various physical parameters of solids, and the detection of local inhomogeneities. The first method calls upon the analysis of the ultrasonic signal (amplitude and phase), after it has crossed a constant thickness of a metallic specimen. This analysis reveals variations of attenuation and of ultrasonic propagation velocity within the specimen. A good spatial resolution is obtained by using 1-mm-dia.probes. The second method leads, thanks to a test rig equipped with broad frequency band electrostatic transducers, to the knowledge of the attenuation law of the specimens as a function of frequency (present range : 5 to 15 MHz); from this is deduced a classification of these specimens as regards their granulometry. Author (ESA)

N76-15480# Naval Ordnance Lab., White Oak, Md.
A GUIDE FOR THE NONDESTRUCTIVE TESTING OF NON-BUTT WELDS IN COMMERCIAL SHIPS, PART 1 Final Report
Robert A. Youshaw and Edward L. Criscuolo 31 Dec. 1974 65 p
(NAVSHIPS Proj. 00-0141)
(AD-A014547; NOLTR-74-138-Pt-1) Avail: NTIS CSCL 13/5

Procedures are presented for performing visual inspection, magnetic particle testing, radiography, ultrasonics, and penetrant testing on steel welds in the thickness range of 1/2 inches to 2 1/2 inches. The basic weld joints considered are the corner joint, the Tee, 'x', and the lap joints. A discussion is presented for each of the inspection methods whereby weld quality may be controlled when there is a need to do so. Author (GRA)

N76-15481# Naval Ordnance Lab., White Oak, Md.
A GUIDE FOR THE NONDESTRUCTIVE TESTING OF NON-BUTT WELDS IN COMMERCIAL SHIPS, PART 2 Final Report
Robert A. Youshaw and Edward L. Criscuolo 31 Dec. 1974 45 p refs
(NAVSHIPS Proj. 00-0141)
(AD-A014548; NOLTR-74-138-Pt-2) Avail: NTIS CSCL 13/5

For abstract, see N76-15480.

N76-15482# System Sciences, Inc., Chapel Hill, N.C.
RESEARCH ON STATISTICAL PROCEDURES IN RELIABILITY ENGINEERING Final Report, 1 May 1973 - 30 Jun. 1974
Ralph A. Evans and Gordon Simons Jun. 1975 75 p refs
(Contract F33615-73-C-4092; AF Proj. 7071)
(AD-A013687; ARL-75-0154) Avail: NTIS CSCL 14/4

The 'time saved on life tests' by using extra items and not waiting until all items fail has been calculated for the exponential, Power-function, and Pareto distributions. The expected values for time ratios are calculated in 3 different ways and the results are quite different. For example, for 7 items tested to the first failures, as compared to 3 items tested to 3 failures, the ratio of expected times is 0.28, whereas the expected ratio is 0.37 (with dependence) and is 0.44 (with independence). GRA

N76-15483# Research Triangle Inst., Durham, N.C.
GUIDELINES FOR DEVELOPMENT OF A QUALITY ASSURANCE PROGRAM, VOLUME 14. SCREENING DETERMINATION OF LEAD IN GASOLINE
D. E. Gilbert, F. Smith, and D. E. Wagnoner Feb. 1975 74 p refs
(Contract EPA-68-02-1234)
(PB-244167/3; EPA-650/4-74-005n) Avail: NTIS HC $4.50 CSCL 14B

Guidelines are presented for developing a quality assurance program for the screening of lead in gasoline by the Federal reference method. These guidelines include: recommended operating practices and techniques; procedures for assessing performance and qualifying data; procedures for identifying trouble and improving data quality; and procedures to permit design of auditing activities. This is an operations manual, designed for use by operating personnel. GRA

N76-15484# Joint Technical Coordinating Group on Electronics Equipment Reliability.
SUMMARY REPORT OF THE JOINT LOGISTICS COMMANDERS ELECTRONICS SYSTEMS RELIABILITY WORKSHOP
1 Aug. 1975 38 p
(Contract N00039-74-C-0066)
(AD-A014568) Avail: NTIS CSCL 09/5

The summary report presents a program plan for improving reliability and procurement practices related to microcircuits. The electronic systems reliability workshop addresses the system reliability problem and considers means of developing improved management procedures, documentation, standards, and analytic and testing techniques for producing more reliable systems.GRA

N76-15485# Naval Weapons Engineering Support Activity, Washington, D.C.
TECHNIQUES FOR SELECTING AND ANALYZING RELIABILITY IMPROVEMENT WARRANTIES Final Report
Joseph A. Bizup and Randall R. Moore Jun. 1975 134 p refs
(AD-A014575; NAVWESA-R-7505) Avail: NTIS CSCL 14/4

Reliability Improvement Warranty (RIW) is a type of contract that makes a contractor responsible for field-induced failures over an extended period of time. Its express purpose is to provide a vehicle for product improvement. This report presents selection criteria for RIW candidates and techniques for risk and economic analyses are developed. Three contracts are analyzed in detail with respect to RIW impact on item procurement and management. The cost effectiveness of two RIW contracts is discussed to indicate areas of probable life-cycle-cost savings to the Navy. GRA

N76-15486# Freudenthal (Alfred M.), Chevy Chase, Md.
RELIABILITY ASSESSMENT OF AIRCRAFT STRUCTURES BASED ON PROBABILISTIC INTERPRETATION OF THE SCATTER FACTOR Final Report, 1 Sep. 1973 - 1 Mar. 1975
Alfred M. Freudenthal Apr. 1975 58 p
(Contract F33615-74-C-5003; AF Proj. 7351)
(AD-A014359; AFML-TR-74-198) Avail: NTIS CSCL 01/3

The 'scatter factor' S as used in fatigue design of aircraft is defined as the ratio between the location parameter (estimate) of the 'population' of all aircraft, obtained from n full-scale tests, and the first failure in a fleet of m aircraft. Introducing the Third Asymptotic distribution of smallest values for the fatigue life of the population, this definition produces a Pareto-type distribution of the scatter-factor, on the basis of which S can be related to the numbers n and m and the reliability level R. Tables of S for different combinations of n, m, R and the 'minimium fatigue life' are evaluated. Useful values of the scatter factor for different materials and purposes are suggested. GRA

N76-15487# Rail Co., Hunt Valley, Md.
DEVELOPMENT PROGRAM FOR AN AIRCRAFT RELIABILITY AND MAINTAINABILITY SIMULATION (ARMS) MODEL VOLUME 1. PROGRAM DESCRIPTION Final Report, Jun. 1974 - Dec. 1975
William C. Friese Jul. 1975 143 p refs
(Contract DAAH02-73-C-0090; DA Proj. 1F1-62205-A-119)
(AD-A014102; USAAMRDL-TR-75-26A) Avail: NTIS CSCL 01/3

The Aircraft Reliability and Maintainability Simulation (ARMS) model concept was developed by the U. S. Army Air Mobility Research and Development Laboratory, Eustis Directorate. The ARMS model is a management tool which permits observation of the impact of a proposed action prior to implementation. The model is used to simulate aircraft operating in user-defined operational and maintenance scenarios. It is designed to allow the user almost complete flexibility in defining aircraft components with their associated failure rates and repair requirements and in defining necessary resources such as ground support equipment. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N76-15488 Polish Academy of Sciences, Warsaw.
THE PROBLEM OF A CIRCULAR PLATE AS A BODY WITH INTERNAL CONSTRAINTS [ZAGADNENIE PLYTY KOLOWEJ JAKO CIALA Z WEWNETRZNYMI WIEZAMI]
Maria Kuczynska-Marks 26 Jul. 1975 15 p refs In POLISH
Avail: Issuing Activity

A plate was examined as a three dimensional body with restraints. General dependences of the plate are discussed, and the example of a circular plate loaded uniformly on the upper surface was investigated. Transl. by M.J.S.

N76-15489 Polish Academy of Sciences, Warsaw.
INVESTIGATION OF COMBINED VIBRATION OF A ROTOR BY THE BALBI MEAN METHOD [BADANIE DRGAN KOMBINOWANYCH WIRNIKA METODA USREDNIANIA BALBIEGO]
Agnieszka Muszynska 29 Aug. 1975 20 p refs In POLISH
Avail: Issuing Activity

An approximation method is presented for solving problems of combined constant vibrations which result from application of self-induced vibrations or vibrations forced by the action of centrifugal forces of inertial and gravitational forces. A numerical analysis is given using Balbi's mean method. Transl. by M.J.S.

N76-15490 Polish Academy of Sciences, Warsaw.
BOUNDARY CONDITIONS OF CONCRETE CABLE SECTIONS REINFORCED WITH SOFT STEEL [STANY GRANICZNE PRZEKROJU KABLOBETONOWEGO]
Wanda Paprocka-Garlicka 7 Jul. 1975 36 p refs In POLISH
Avail: Issuing Activity

A proposed destruction theory is compared with the classical theory of boundary wear. A numerical analysis is presented, and results are discussed. Flat sections and ideal elasto-plastic sections are conserved by concrete and steel. Transl. by M.J.S.

N76-15491 Polish Academy of Sciences, Warsaw.
INTRODUCTION TO ANALYTICAL MECHANICS OF MATERIAL CONTINUUM. PART 1: CONTINUA WITH

GEOMETRIC CONSTRAINTS [WSTEP DO MECHANIKI ANALITYCZNEJ KONTINUUM MATERIALNEGO. CZESC 1: KONTINUA Z WIEZAMI GEOMETRYCZNYMI]
Czeslaw Wozniak 25 Jun. 1975 78 p refs In POLISH
Avail: Issuing Activity

Continuum material mechanics and mechanical constraints are discussed along with conservation equations, kinetic boundary conditions, elastic bodies, plate theory, shell theory, thin-walled rods, the Lagrange equation, equations defining constraints, and the discrete theory of elasticity. Transl. by M.J.S.

N76-15492 Polish Academy of Sciences, Warsaw.
FINITE ELEMENT METHOD IN THE MECHANICS OF DEFORMED BODIES [METODA ELEMENTOW SKONCZONYCH W MECHANICE CIAL ODKSZTALCALNYCH]
Jozef J. Telega 29 Sep. 1975 107 p refs In POLISH
Avail: Issuing Activity

Literature on the finite element method and its applications is briefly reviewed. An extensive bibliography is presented on the following subjects: general problems and the use of the finite element method, fluid mechanics, hydroelasticity, pressure vessels, shells, plates and disks, and fracture mechanics.
Transl. by M.J.S.

N76-15493 Polish Academy of Sciences, Warsaw.
LARGE DYNAMIC DEFLECTIONS OF LIGHTENED STRUCTURES. CRITICAL SURVEY OF EXISTING THEORIES [DUZE UGIECIA DYNAMICZNE OBCIAZONYCH KONSTRUKCJI. KRYTYCZNY PRZEGLAD ISTNIEJACYCH TEORII]
Tomasz Wierzbicki 6 Sep. 1975 52 p refs In POLISH
Avail: Issuing Activity

The classification and critical analysis is presented of literature materials on the subject of large dynamic deflections in plastic and viscoplastic construction. Topics discussed include solutions for precise and approximate conditions of plasticity, approximation method for kinematically permissible velocity fields, approximation method for statistically permissible stress fields, large elastic deflections, and variation methods. Transl. by M.J.S.

N76-15494 Illinois Inst. of Tech., Chicago.
MULTIPLE DIFFRACTIONS OF ELASTIC WAVES BY A RIGID RECTANGULAR FOUNDATION Ph.D. Thesis
Marijan Dravinski 1975 387 p
Avail: Univ. Microfilms Order No. 75-30003

The literature is reviewed and the evolution of various methods applied in order to solve the problems of diffraction of elastic waves by an obstacle is demonstrated. A brief review is included of integral transforms which are used in Kontorovich-Lebedev, Laplace and Fourier integral transforms. The problem of decomposition into radiation and diffraction sub-problems for the general problems of diffraction of elastic waves by an embedded obstacle is discussed. For the anti-plane strain model, the first order response is derived of a rigid rectangular obstacle embedded in an elastic half-space and subjected to a plane incident wave. For the plane strain model, the first order response was studied for a vertical radiation of the rigid rectangular obstacle embedded in an elastic half-space. The results of the first order response are given in a closed form and compared to the corresponding zeroth order solutions. It was found that the zeroth order solutions can be used as very good approximation beyond the interval of time where they are exact. Dissert. Abstr.

N76-15495 Connecticut Univ., Storrs.
VIBRATION AND STABILITY OF A SPINNING ANNULAR PLATE REINFORCED WITH EDGE BEAMS Ph.D. Thesis
Hsiao Chi Loh 1975 69 p
Avail: Univ. Microfilms Order No. 76-1681

The exact solution is presented for both the natural frequencies and buckling loads of a radially compressed spining annular plate reinforced with edge beams at the inner and outer edges. A uniform, ring-type load is radially applied to the simply supported inner edge beam along its entire length, while the outer edge beam is either simply supported or free and without tractions. The system is spinning with constant angular velocity about an axis through its center and perpendicular to its plane. The Frobenius method is applied to the plate equation and the infinite series solution for deflection is shown to be absolutely covergent. Applying appropriate boundary conditions leads to a four by four characteristic determinant which is set to be zero to determine the nontrivial solution to the problem. Dissert. Abstr.

N76-15496 West Virginia Univ., Morgantown.
A FINITE ELEMENT PROGRAM FOR FREE FORM SHELLS Ph.D. Thesis
Roger Rene Takacs 1975 331 p
Avail: Univ. Microfilms Order No. 76-772

The finite method was used to investigate the deflectional and stress behavior of conoidal shells. Basic concepts of the finite element method are described and the development of the method is outlined in chronological order. To be able to put the finite element method into application, special computer algorithms were developed. Preliminary computer analyses of beam, plate and shell structures were run to determine, in relation with available reference results for deflections and stresses, the effectiveness of the FORTRAN program gradually improved during its development. Shortening of the execution time, optimizing the data imput procedure, finding a systematic method to compare the results obtained (several thousand of them) with available reference values, selecting the best formulations: These are some of the main results of the study. Dissert. Abstr.

N76-15497 New Mexico State Univ., University Park.
A METHOD FOR DETERMINATION OF THE BUCKLING LOADS OF ELASTIC STRUCTURES Ph.D. Thesis
Thomas Golden Morrison 1975 92 p
Avail: Univ. Microfilms Order No. 76-714

It is shown that the equations governing the physical behavior of structures subject to buckling can be divided into two groups of terms. The first group includes only those terms that reflect the equilibrium conditions for the structure; they do not contribute to the buckling phenomenon. The second group of terms accounts for the peculiar characteristics of the structure and its loading that lead to buckling. In general, they are considerably more complicated than the first group. The first group of terms defines a set of orthomormal vector functions. It is further shown that closed form equations for the buckling loads can be deduced from the complete equations in terms of these functions. For some systems the resulting solutions are mathematically accurate; for many more systems the solutions are approximate, but very accurately approximate. These relations are expressed in terms of two operators, the equilibrum operator representing the first group of terms and the buckling operator representing the second group. Dissert. Abstr.

N76-15498*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
EXPERIMENTAL TRANSIENT AND PERMANENT DEFORMATION STUDIES OF STEEL-SPHERE-IMPACTED OR IMPULSIVELY-LOADED ALUMINUM BEAMS WITH CLAMPED ENDS
Emmett A. Witmer Oct. 1975 111 p refs
(Grant NGR-22-009-339)
(NASA-CR-134922; ASRL-TR-154-11) Avail: NTIS HC $5.50 CSCL 20K

The sheet explosive loading technique (SELT) was employed to obtain elastic-plastic, large-deflection transient and/or permanent strain data on simple well-defined structural specimens and materials: initially-flat 6061-T651 aluminum beams with both ends ideally clamped via integral construction. The SELT loading technique was chosen since it is both convenient and provides forcing function information of small uncertainty. These data will be useful for evaluating pertinent structural response prediction methods. A second objective was to obtain high-quality transient-strain data for a well-defined structural/material model subjected to impact by a rigid body of known mass, impact velocity, and geometry; large-deflection, elastic-plastic transient response conditions are of primary interest. The beam with both ends clamped and a steel sphere as the impacting body were chosen. The steel sphere was launched vertically by explosive propulsion to achieve various desired impact velocities. The sphere/beam impact tests resulted in producing a wide range of structural responses and permanent deformations, including rupture of the beam from excessive structural response in two cases. The transient and permanent strain data as well as the permanent deflection data obtained are of high quality and

should be useful for checking and evaluating methods for predicting the responses of simple 2-d structures to fragment (sphere) impact. Transient strain data very close to the point of impact were not obtained over as long a time as desirable because the gage(s) in that region became detached during the transient response.
Author

N76-15499 Royal Aircraft Establishment, Farnborough (England).
THE VALUE OF SURFACE-PROTECTIVE MEDIA AGAINST FRETTING CORROSION ON THE BASIS OF FATIGUE STRENGTH TESTS
E. Gassner Oct. 1975 11 p refs Transl. into ENGLISH from Lab. fuer Betriebsfestigkeit Report TM-19/67
(RAE-Lib-Trans-1868; BR49980; TM-19-67) HC $3.50

A fatigue test specimen is described which was designed specifically for evaluating the effect of anti-fretting media on fatigue life. By varying the method of assembly the specimen can be made to fail at areas of fretting accompanied by high or low stress concentration, or at a stress concentration without fretting. The use of this specimen in assessing anti-fretting media is discussed.
Author

N76-15500*# Astro Research Corp., Santa Barbara, Calif.
SURVEY OF FUTURE REQUIREMENTS FOR LARGE SPACE STRUCTURES Final Report
John M. Hedgepeth Washington NASA Jan. 1976 53 p refs
(Contract NAS1-13178)
(NASA-CR-2621) Avail: NTIS HC $4.50 CSCL 20K

The future requirements for large space structures were examined and the foundation for long range planning of technology development for such structures is provided. Attention is concentrated on a period after 1985 for actual use. Basic ground rule of the study was that applications be of significant importance and have promise of direct economic benefit to mankind. The inputs to the study came from visits to a large number of government and industrial organizations, written studies in current literature, and approximate analyses of potential applications. The paper identifies diverse space applications for large area structures in three general categories: (1) large surfaces for power, (2) large antenna to receive and transmit energy over the radio frequency bandwidth, and (3) space platforms to provide area for general utilizations.
Author

N76-15501# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE EFFECTS OF LOAD DWELLS DURING FATIGUE CRACK PROPAGATION
London Aeron. Res. Council 1975 14 p refs Supersedes RAE-TR-74163; ARC-35906
(ARC-CP-1318; RAE-TR-74163; ARC-35906) Avail: NTIS HC $3.50; HMSO 25p; PHI $1.15

To substantiate the increase of endurance, a research program was undertaken to investigate the effect of dwells in fatigue loading on crack propagation rate in thin sheet Al 2% Cu specimens. The fatigue loading used was a simplified flight-by-flight load sequence and, in tests including dwell periods, dwells were either at steady tension or at zero load. It is shown that dwells in fatigue loading significantly reduced crack growth rates; dwells at a steady load were possibly more beneficial than dwells at zero load. Possible mechanisms are discussed and further research programs are outlined which should provide a better understanding of these mechanisms.
Author (ESA)

N76-15502# Hawker Siddeley Dynamics Ltd., Hatfield (England). Space Div.
A LITERATURE SURVEY OF THE ACOUSTIC EXCITATION OF HONEYCOMB SANDWICH STRUCTURES AND SHALLOW SHELLS
J. J. Pocha Oct. 1975 123 p refs
(Contract ESTEC-2143/73)
(HSD-TP-7551; ESA-CR(P)-731) Avail: NTIS HC $5.50

The main topics covered in the literature survey on the acoustic excitation of honeycomb sandwich structures and shallow shells, are: the flexural behavior, the modal density, and the damping of honeycomb sandwich structures, and the modal density of shallow shells. The application of the statistical energy method of structural analysis is discussed. The output of a computer-based literature search is presented.
Author (ESA)

N76-15503# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DEFORMATION AT HIGH TEMPERATURE OF COPPER-SILICA DISPERSION STRENGTHENED ALLOYS Ph.D. Thesis - Paris Univ.
Rene Ramboarina Nov. 1974 66 p refs In FRENCH; ENGLISH summary Report will also be announced as translation
(ONERA-NT-224) Avail: NTIS HC $4.50

Copper single crystals containing a volume fraction f of silica were made by internal oxidation at 700 C of copper-silicon single crystals (fractions f = 0.4, 0.8 and 4% were made). Creep of such crystals were studied at temperatures above 500 C. When creep is obtained in tension, premature strictions appear in the specimen, which render the results difficult to exploit. Activation parameters of steady state creep were measured: the activation energy was found equal to the copper auto-diffusion energy in the range explored; the exponent characterizing the influence of stress on the steady state creep rate is 2 to 5 according to composition and temperature. The single crystals under study exhibit a behavior more similar to that of pure copper than to that of other dispersion strengthened alloys (Al-Al2O3 or Ni-ThO2). The various factors which explain this difference were examined (particle size, dislocation microstructure, crystallographic orientation).
Author (ESA)

N76-15504# Watervliet Arsenal, N.Y.
THE OPTIMIZATION OF HAUGER'S PROBLEM WITH DAMPING FOR A CIRCULAR GEOMETRY
C. R. Thomas Jun. 1975 33 p refs
(DA Proj. 1F1-61102-A-35D)
(AD-A014189; WVT-TR-75032) Avail: NTIS CSCL 13/13

Hauger's problem with a circular cross-section, with Kelvin-Voigt internal and linear external damping assumed, is optimized within the bounds of a special class of generalized parabola type boundary curves where beam diameter is expressed functionally in terms of axial displacement. In going to a Rosenbrock optimization routine with a minimum tip diameter constraint imposed, it was quite clear that mass ratio reductions of the order of 27% are possible.
Author (GRA)

N76-15505# Naval Ship Research and Development Center, Bethesda, Md.
DATA GENERATION FOR FINITE-ELEMENT STRUCTURAL ANALYSIS OF THREE-DIMENSIONAL NAVAL SHIP STRUCTURES
Paul M. Meyer Jun. 1975 86 p
(SF43422703)
(AD-A014125; NSRDC-4637) Avail: NTIS CSCL 13/10

A computer program has been developed to automatically discretize three-dimensional structures consisting of combinations of cross-stiffened grillages. Discretizing is dividing a continuous structure into a number of connected parts so that the sum of the collection of parts equals the total structure. The purpose of this computer program is to shorten the preliminary work time involved in preparing data for analysis by the finite-element method. The grillages can have multiple openings with coamings, and the computer program can also generate the cards that describe inplane and normal uniform loads. Input to the program consists of punched cards which define structural geometry, boundary conditions, and loadings. Output consists of a disk file which can be read directly either by NASTRAN or by a special utility program to produce plots of the discretized structure. Access can also be obtained at a later time by a special purpose program which displays the discretized structure at an interactive graphics terminal. The validated data can then be made accessible to NASTRAN for a finite-element analysis. Modifications to this program will extend the current capability of the program for discretizing from simple warped surfaces to more complex curved surfaces and will allow use of the program on either a UNIVAC-1108 or an IBM-360/91 computer.
Author (GRA)

N76-15506# Trinity Coll., Dublin (Ireland). School of Engineering.
FURTHER INVESTIGATIONS TOWARDS A RATIONAL METHOD OF DESIGN FOR FLEXIBLE PAVEMENTS Final Report

R. W. Kirwan and M. S. Snaith May 1975 111 p refs
(Grant DA-ERO-591-73-G-0017; DA Proj. 2M0-611-B-52B)
(AD-A014169) Avail: NTIS CSCL 13/2

A rational design procedure for flexible pavements is presented. The analysis of pavement structures is demonstrated using an improved computer program. Test tracks from other centres of research are used to test the ability of the program to predict permanent surface deformation under traffic loading. The creep characteristics of a dense bitumen macadam are analysed and a relationship suggested that links the permanent strain behavior under static and dynamic loading. GRA

N76-15507# Washington State Dept. of Highways, Olympia.
PAVEMENT DEFLECTION MEASUREMENT - DYNAMIC Final Research Program Report
Frank W. Brands and John C. Cook Feb. 1975 117 p refs
Sponsored in part by Fed. Highway Admin.
(PB-244461/0; RPR-3.5; H-42) Avail: NTIS HC $5.50 CSCL 13B

Tests were conducted on various pavements to investigate the correlation between measurements obtained using the impulse index computer and pavement condition as determined by other means. Benkelman beam deflection measurements and impulse index measurements are compared along with Washington State pavement rating system results. Effect of temperature on the apparent impulse index is evaluated. GRA

N76-15508# Transportation Research Board, Washington, D.C.
CONCRETE PAVEMENT CONSTRUCTION AND JOINTS AND LOADER-TRUCK PRODUCTION STUDIES
1975 104 p refs
(PB-244108/7; TRB/TRR-535; ISBN-0-3090-2386-6) Avail: NTIS HC $5.50 CSCL 13B

Studied are the following subjects: Development of a specification to control rigid pavement roughness; New York's experience with plastic coated dowels; concrete pavement jointing and sealing methods; performance evaluation of Utah's concrete pavement joint seals; some refinements in expansion joint systems; prestressed pavement demonstration project; depth of concrete cover over bridge deck reinforcement; and the use of time lapse photography and computer simulation for loader-truck production studies. GRA

N76-15509# Catholic Univ. of America, Washington, D.C. Stress Analysis Lab.
ELASTOSTATICS OF A CUBIC BOX SUBJECTED TO CONCERNED LOADS
A. J. Durelli, V. Pavlin, Jo. O. Buhler-Vidal, and G. Ome Aug. 1975 32 p refs
(Contract N00014-75-C-0663; Grant NSF GK-16907; CUA Proj. 1.043.201; CUA Proj. 4.043.010)
(AD-A014357; Rept-37) Avail: NTIS CSCL 20/11

This paper deals with the experimental strain, stress and deflection analysis of a cubic box subjected to concentrated loads applied at the center of two opposite faces. The ratio between the inside span and the wall thickness varied between approximately 5 to 14. All corners had circular fillets. The experimental analysis was conducted using mechanical and electrical strain gages and brittle coatings. Results, given parametrically by means of a family of curves representing normalized stresses are applicable to boxes of any size, made of any elastic materials, provided the wall thickness falls within the investigated ranges. Some results obtained using the theory of structures approach are included for comparison purposes and presented in a form useful to designers. GRA

N76-15510# Washington State Univ., Pullman. Dept. of Pure and Applied Mathematics.
A SYNTHESIS OF CRACK GROWTH THEORIES IN FATIGUE INTO SOME STATISTICAL DISTRIBUTIONS OF FATIGUE LIFE Interim Report, 15 Sep. 1973 - 15 Sep. 1974
Sam C. Saunders Jun. 1975 61 p refs
(Contract F33615-73-C-4016; AF Proj. 7071)
(AD-A014394; ARL-75-0178) Avail: NTIS CSCL 20/11

The proposed model for fatigue life is a synthesis of the distributional properties of three separate phases of fatigue crack growth. The convolved distribution of life contains three estimable parameters and a function disposable within a restricted class. The problem of estimating all three parameters using the method of maximum likelihood is examined and shown to be impossible of solution in certain cases. This indicates that one of the parameters must be determined a priori from concepts of strength of materials or fracture mechanics. GRA

N76-15511# Watervliet Arsenal, N.Y.
ENERGY RELEASE RATE IN TERMS OF COMPLEX ANALYTIC FUNCTIONS
M. A. Hussain and S. L. Pu Jun. 1975 21 p refs
(AD-A014186; WVT-TR-75031) Avail: NTIS CSCL 20/11

The energy release rate for two dimensional cracks subjected to either plane loading or anti-plane shear is most commonly computed by Irwin's crack closure method or the path independent integrals used by Rice. In terms of analytic functions of a complex variable, these two approaches give two distinct expressions for the energy release rate. For instance, for plane problems the energy release rate is given in terms of one analytic function using Irwin's approach while the same is expressed in terms of two analytic functions by the method of path independent integrals. For special cases, such as Mode I crack, these two expressions lead to identical results. However, the identity for the general case has not been established. In this report we have shown that the expression of energy release rate for plane problems in terms of two analytic functions can be further reduced to the same expression obtained by Irwin's method in terms of only one analytic function and that the two distinct expressions of energy release rate for anti-plane problems are identical. GRA

N76-15512# Watervliet Arsenal, N.Y.
THE INFLUENCE OF ELASTIC MODULI DAMPING RATIOS ON THE STABILITY OF A DOUBLE PENDULUM
G. L. Anderson and T. E. Simkins Jun. 1975 16 p refs
(AD-A014205; WVT-TR-75027) Avail: NTIS CSCL 20/11

The effects of hinge compliance and damping on the critical flutter load of a double pendulum with viscoelastic hinges at its pinned joints and subjected to a tangential force applied at its free end are investigated. The analysis shows that the critical flutter load is strongly influenced by the ratios of the elastic and viscous moduli of the springs in the two hinges in the system. GRA

N76-15513# Watervliet Arsenal, N.Y.
AN INITIAL VALUE PROBLEM OF CRACK PROPAGATION IN ANTI-PLANE STRAIN
Robert L. Ryan Jun. 1975 36 p refs
(AD-A014188; WVT-TR-75030) Avail: NTIS CSCL 20/11

A problem of Mode III crack propagation is considered in which the crack tip speed is an arbitrary function of time. For purposes of comparison and elucidation, the solution is obtained by two independent methods. By one method the problem is reduced to a standard Abel integral equation through the use of integral transforms; by the alternative method the problem is formulated as a Riemann-Hilbert problem through the use of complex variables. It is found that the transient component of the problem can be constructed from an equivalent static problem by properly adjusting the crack tip position. Author (GRA)

N76-15514# Watervliet Arsenal, N.Y.
THE COMPUTATION OF THE FLUTTER LOAD OF A SYSTEM OF TWO DEGREES OF FREEDOM WITH ARBITRARILY SMALL VELOCITY DEPENDENT FORCES
G. L. Anderson Jun. 1975 19 p refs
(AD-A014191; WVT-TR-75034) Avail: NTIS CSCL 20/11

With the aid of a perturbation technique, a formula is derived for the purpose of determining the exact value of the critical flutter load Q sub d of a non-gyroscopic system of two degrees of freedom, subjected to a non-conservative force, in the limit as the value of the internal damping parameter becomes vanishingly small. The principal results of the general theory are applied to obtain an expression for Q sub d for a double pendulum, which has viscoelastic hinges, rotating at constant angular velocity, carrying a tip mass, and subjected to a tangential force at its free end. Author (GRA)

N76-15515# Watervliet Arsenal, N.Y.
THE STABILITY AND NON-LINEAR VIBRATIONS OF AN

ORTHOTROPIC HINGED-HINGED BEAM
G. L. Anderson Jun. 1975 65 p refs
(AD-A014190; WVT-TR-75036) Avail: NTIS CSCL 20/11

The field equations for the general non-linear theory of elasticity are expressed in variational form. Under the assumption of infinitesimal strains and small rotations, Euler-Bernoulli and Timoshenko type theories for the non-linear flexural vibrations of hinged-hinged beams are derived with the aid of this generalized form of Hamilton's principle. It is assumed that the beam is subjected to a sinusoidal forcing function applied along the length of the beam, and attention is focused upon a determination of the steady state periodic motions of the system. Frequency-amplitude plots are given for various values of the parameter which measures the degree of anisotropy of the system. The stability of the periodic motions is then considered, and Hsu's method is employed for the purpose of establishing the zones of stability in a frequency-amplitude diagram. Author (GRA)

42 GEOSCIENCES (GENERAL)

N76-15516# National Climatic Center, Asheville, N.C.
USE OF CLIMATIC DATA IN DESIGN OF SOILS TREATMENT SYSTEMS Final Report, 11 Mar. 1974 - 28 Feb. 1975
Dick M. Whiting Jun. 1975 76 p refs
(PB-244098/0; EPA-660/2-75-018) Avail: NTIS HC $5.00 CSCL 02C

Planners, designers and operators of landbased wastewater management systems need information about climatic influences on the determination of storage requirements. Parameters of special interest are discussed and two guidelines have been developed. A number of graphs, charts and maps are included to describe ways of presenting climatological data and to show the availability of summarized climatic elements. Air temperature, ground frost, evaporation, precipitation, snowfall, snow depth and wind direction and speed are discussed in relation to the possible affect of each on land application systems. GRA

N76-15517# Wisconsin Univ., Milwaukee.
SOURCES OF WATER QUALITY, LAKE LEVEL, ICE, WATER TEMPERATURE AND METEOROLOGICAL DATA FOR THE SAINT LAWRENCE GREAT LAKES
Alfred M. Beeton and John W. Strand Jan. 1975 194 p refs Sponsored by NOAA
(COM-75-11177/3; WIS-SG-75-410; Sea-Grant-10; NOAA-75080512) Avail: NTIS HC $7.50 CSCL 13B

Data sources included are municipal, industrial, power plant and a few military water treatment plants. Published water quality data from academic, governmental or private sources were not included. The data sources were not used by many investigators because of the inaccessibility of the data or many people were not aware of its existence. Information on sources of raw numerical data is included. The data are divided into two parts; hydrographic and meteorological. The hydrographic section deals with water intakes in one of the five Great Lakes or their interconnecting waterways. GRA

N76-15518# Stanford Univ., Calif. Dept. of Civil Engineering.
TWO-DIMENSIONAL HYDROSTATIC SIMULATION OF THERMALLY-INFLUENCED HYDRODYNAMIC FLOWS
B. R. Roberts and R. L. Street Jul. 1975 174 p refs
(Contract DI-14-31-0001-3675)
(PB-244535/1; TR-194; W75-10901; OWRT-C-3033(3675)(1)) Avail: NTIS HC $6.75 CSCL 08H

A simplified and two-dimensional, numerical model is described, capable of representing stratification and thermally unstable flows in lakes. The Navier-Stokes equations, a heat balance equation, the continuity equation, and an equation relating fluid density to temperature are combined to form a closed system. The Boussinesq approximation is used; a hydrostatic pressure distribution is assumed. A subgrid-scale turbulence model provides a variable eddy viscosity for diffusion calculations. Upstream differencing was used for convection terms, and FORTRAN is the program language. Favorable comparisons with other models were obtained. A long-term, large-scale stratification process was simulated and quantitative agreement with laboratory experiments was obtained. GRA

N76-15519# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
COMPARATIVE ANALYSIS OF ESTIMATION METHODS IN NONLINEAR FUNCTIONAL MODELS OF THE RAINFALL-RUNOFF PROCESS Final Report, Sep. 1970 - Dec. 1974
A. Ramachandra Rao and R. G. Srinivasa Rao Dec. 1974 118 p refs
(PB-244887/6; TR-56; W75-11354; OWRT-B-025-IND(5)) Avail: NTIS HC $5.50 CSCL 08H

The methods of estimation of kernel functions of nonlinear functional models proposed by Brandsetter and Amorocho, Boneh and Diskin, Bidwell, and Roy and Sherman are compared. The rainfall-runoff data from an urban (Ross Ade) watershed in West Lafayette, Indiana were used in the study. The computational complexity, the performance of the estimated kernels in both the regeneration and prediction modes were used for comparing the different methods of estimation of kernel functions. The analysis was conducted to select a method which can be easily used and which is also accurate. The second objective was to demonstrate the utility of the functional series models in simulating the short time increment runoff process. The nonlinear functional model can be used for simulation of runoff provided the kernel functions of these models are accurately estimated. GRA

N76-15520# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
IMPROVED APPLICATION OF GEOPHYSICS TO GROUND-WATER RESOURCES INVENTORIES IN GLACIATED TERRAINS Technical Report, 1 Jul. 1973 - 30 Jun. 1975
Jerald M. Adams, William J. Hinze, and Lynn A. Brown Jul. 1975 71 p refs
(PB-244879/3; TR-59; W75-11355; OWRT-A-030-IND(1)) Avail: NTIS HC $4.50 CSCL 08H

The use of gravity method for geophysical mapping of buried bedrock topography was discussed. The role bedrock topography in groundwater resource inventories was also covered. Where the density contrast between the bedrock and the overlying earth materials is constant, the bedrock elevation data obtained from drill holes, outcrops, and seismic studies combined with gravity data can be used to isolate the gravity effects from bedrock relief. Preliminary induced polarization (I.P.) studies indicate that measurable I.P. effects occur within glacial sediments. A limitation of the method is the number of bedrock elevation points available to compare with observed gravity data. GRA

N76-15521# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
MOISTURE AND ENERGY CONDITIONS IN A DRAINING SOIL MASS
Wade L. Nutter Jun. 1975 88 p refs Prepared in cooperation with Georgia Univ.
(Contract DI-14-31-0001-3510)
(PB-244726/6; ERC-0875; W75-11054; OWRT-A-025-GA(2)) Avail: NTIS HC $5.00 CSCL 08H

A soil model was constructed which could be mechanically raised from the horizontal to a 27-degree angle. It was packed with a mixed subsurface horizon soil composed of 51% sand, 21% silt and 28% clay. The objective was to study the effects of slope angle and soil depth on the moisture and energy conditions within a draining soil mass and their relationship to streamflow depletion. Three slopes (25, 15 and 5 degrees) were drained at three depths (120, 80 and 40 cm). As drainage continues the equipotential lines of hydraulic head approach a position normal to the surface. The degree of divergence from normal increases with decrease in slope angle. Water content gradients suggest that a zone of active water movement migrates downslope during drainage and may migrate back upslope during rainfall. Of the variables studied, slope angle exerts the greatest influence over the nature of drainage from a soil mass. GRA

N76-15522# Arizona Univ., Tucson. School of Renewable Natural Resources.
AN ASSESSMENT OF SNOWPACK DEPLETION-SURFACE RUNOFF RELATIONSHIPS ON FORESTED

WATERSHEDS Research Project Completion Report, Jul. 1973 - Jun. 1974
Peter F. Ffolliott and David B. Thorud Aug. 1975 7 p
(Contract DI-14-31-0001-5003)
(PB-244697/9; W75-11049; OWRT-A-045-ARIZ(3)) Avail: NTIS HC $3.50 CSCL 08H

A technique was developed for determining daily values of snowmelt runoff efficiencies from small forested watersheds by coupling a computer program that simulates Arizona snowmelt processes with graphical procedures of runoff hydrograph separation. Employing this technique, seven watersheds with 14 years of record were used in evaluating changing patterns of snowmelt runoff efficiencies within a year. Additionally, an array of physical, biological, and climatic variables were empirically correlated with snowmelt runoff efficiencies to identify the factors affecting efficiencies both within and among snowmelt-runoff seasons. Inventory-prediction equations were also formulated for use in the stratification of high water-yielding watershed source areas. GRA

N76-15523# Washington Univ., Seattle. Arctic Ice Dynamics Joint Experiment Office.
AIDJEX BULLETIN NUMBER 29
Jul. 1975 185 p refs
(Contract NSF C-625)
(PB-244424/8; AIDJEX-75-29) Avail: NTIS HC $7.50 CSCL 08L

Much of AIDJEX Bulletin No. 29 is devoted to further discussion of the AIDJEX sea ice model. In particular the ice-ocean momentum transfer, the planetary boundary layer parameters, and the effect of changing the yield surface are discussed. The remote sensing plan for the AIDJEX main experiment field operations from late February to early June is also included. Other articles deal with using ERTS photographs to test ice thickness redistribution, measuring the turbulent boundary layer under pack ice, and modeling the seasonal ablation and accretion of Antarctic sea ice. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-15524 Denver Univ., Colo.
GEOGRAPHIC RESEARCH FROM EARTH ORBIT, WITH SPECIAL EMPHASIS ON LAND-USE Ph.D. Thesis
Charles Theodore Naftel Paludan 1975 166 p
Avail: Univ. Microfilms Order No. 76-1241

It is proposed that the availability of repetitive observations from satellites yields information of significant benefit to the study of geography. A specific example of a land use survey of a selected test site was used to test the theory. Data from the LANDSAT 1 satellite, from aircraft at very high and medium altitudes, and from ground surveying were used. Objectives of the study were: (1) to develop new approaches and ways of measuring interrelationships, (2) to attempt to study all significant phenomena in a area, (3) to include temporal data, (4) to study human/nature relationships, and (5) to determine areal distributions and pattern associations. The test site was located in Madison County, Alabama. During analysis of the data, several maps were produced. Using these maps as information products, tests were applied to show that the experimental objectives were met.
Dissert. Abstr.

N76-15525*# Kentucky Univ. Research Foundation, Lexington. Dept. of Forestry.
REMOTE SENSING OF EFFECTS OF LAND-USE PRACTICES ON WATER QUALITY
Donald H. Graves [1975] 18 p
(Contract NAS8-31006)
(NASA-CR-144105) Avail: NTIS HC $3.50 CSCL 08H

Research efforts are presented for the use of remote sensing in environmental surveys in Kentucky. Ground truth parameters were established that represent the vegetative cover of disturbed and undisturbed watersheds in the Cumberland Plateau of eastern Kentucky. Several water quality parameters were monitored of the watersheds utilized in the establishment of ground truth data. The capabilities of multistage-multispectral aerial photography and satellite imagery were evaluated in detecting various land use practices. The use of photographic signatures of known land use areas utilizing manually-operated spot densitometers was studied. The correlation of imagery signature data to water quality data was examined. Potential water quality predictions were developed from forested and nonforested watersheds based upon the above correlations. The cost effectiveness of predicting water quality values was evaluated using multistage and satellite imagery sampling techniques. Author

N76-15526*# Virginia Inst. of Marine Science, Gloucester Point.
APPLICATIONS OF REMOTE SENSING TO ESTUARINE PROBLEMS Annual Report
John C. Munday, Jr. Dec. 1975 178 p refs
(Grant NGL-47-022-005)
(NASA-CR-146075; AR-3) Avail: NTIS HC $7.50 CSCL 08J

A variety of siting problems for the estuaries of the lower Chesapeake Bay have been solved with cost beneficial remote sensing techniques. Principal techniques used were repetitive 1:30,000 color photography of dye emitting buoys to map circulation patterns, and investigation of water color boundaries via color and color infrared imagery to scales of 1:120,000. Problems solved included sewage outfall siting, shoreline preservation and enhancement, oil pollution risk assessment, and protection of shellfish beds from dredge operations. Author

N76-15527*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CLASSIFICATION OF MULTISPECTRAL IMAGE DATA BY EXTRACTION AND CLASSIFICATION OF HOMOGENEOUS OBJECTS
R. L. Kettig and D. A. Landgrebe 1975 19 p refs
(Contract NAS9-14016; Grant NGL-15-005-112)
(NASA-CR-147406; LARS-Inform-Note-062375) Avail: NTIS HC $3.50 CSCL 09B

A method of classification of digitized multispectral image data is described. It is designed to exploit a particular type of dependence between adjacent states of nature that is characteristic of the data. The advantages of this, as opposed to the conventional per point approach, are greater accuracy and efficiency, and the results are in a more desirable form for most purposes. Experimental results from both aircraft and satellite data are included. Author

N76-15528*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CROP IDENTIFICATION TECHNOLOGY ASSESSMENT FOR REMOTE SENSING (CITARS)
Marvin E. Bauer, Tina K. Cary, Barbara J. Davis, and Philip H. Swain 1975 59 p refs
(Contract NAS9-14016)
(NASA-CR-147389; LARS-Inform-Note-07215) Avail: NTIS HC $4.50 CSCL 02C

The results of classifications and experiments performed for the Crop Identification Technology Assessment for Remote Sensing (CITARS) project are summarized. Fifteen data sets were classified using two analysis procedures. One procedure used class weights while the other assumed equal probabilities of occurrence for all classes. In addition, 20 data sets were classified using training statistics from another segment or date. The results of both the local and non-local classifications in terms of classification and proportion estimation are presented. Several additional experiments are described which were performed to provide additional understanding of the CITARS results. These experiments investigated alternative analysis procedures, training set selection and size, effects of multitemporal registration, the spectral discriminability of corn, soybeans, and other, and analysis of aircraft multispectral data. Author

N76-15529*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
REMOTE TERMINAL SYSTEM EVALUATION
T. L. Phillips, H. L. Grams, J. C. Lindenlaub, S. K. Schwingendorf, P. H. Swain, and W. R. Simmons 1975 58 p refs

(Contract NAS9-14016; Grant NGL-15-005-112)
(NASA-CR-147402; LARS-Inform-Note-062775) Avail: NTIS HC $4.50 CSCL 09B

An Earth Resources Data Processing System was developed to evaluate the system for training, technology transfer, and data processing. In addition to the five sites included in this project two other sites were connected to the system under separate agreements. The experience of these two sites is discussed. The results of the remote terminal project are documented in seven reports: one from each of the five project sites, Purdue University, and an overview report summarizing the other six reports. Author

N76-15530*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

A CASE STUDY USING LARSYS FOR ANALYSIS OF LANDSAT DATA

Tina K. Cary and John C. Lindenlaub 1975 142 p
(Contract NAS9-14016)
(NASA-CR-147404; LARS-Inform-Note-050575) Avail: NTIS HC $6.00 CSCL 09B

Techniques are described for analysis of LANDSAT multispectral using the LARSYS data processing system. J.M.S.

N76-15531*# Purdue Univ., Lafayette, Ind. The Lab. for Applications of Remote Sensing.

THE LARSYS EDUCATIONAL PACKAGE: INSTRUCTOR'S NOTES

John C. Lindenlaub and Shirley M. Davis 1974 70 p
(Contract NAS9-14016)
(NASA-CR-147391; LARS-Inform-Note-110574) Avail: NTIS HC $4.50 CSCL 09B

Materials are presented for assisting instructors in teaching the LARSYS Educational Package, which is a set of instructional materials to train people to analyze remotely sensed multispectral data. The seven units of the package are described. These units are: quantitative remote sensing, overview of the LARSYS software system, the 2780 remote terminal, demonstration of LARSYS on the 2780 remote terminal, exercises, guide to multispectral data analysis, and a case study using LARSYS for analysis of LANDSAT data. F.O.S.

N76-15532*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

ELECTRICAL METHODS OF DETERMINING SOIL MOISTURE CONTENT

L. F. Silva, F. V. Schultz, and J. T. Zalusky [1975] 223 p refs
(Contract NAS9-14016)
(NASA-CR-147390; LARS-Inform-Note-112174) Avail: NTIS HC $7.75 CSCL 08M

The electrical permittivity of soils is a useful indicator of soil moisture content. Two methods of determining the permittivity profile in soils are examined. A method due to Becher is found to be inapplicable to this situation. A method of Slichter, however, appears to be feasible. The results of Slichter's method are extended to the proposal of an instrument design that could measure available soil moisture profile (percent available soil moisture as a function of depth) from a surface measurement to an expected resolution of 10 to 20 cm. Author

N76-15533*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

THE USE OF ERTS-1 MULTISPECTRAL IMAGERY FOR CROP IDENTIFICATION IN A SEMI-ARID CLIMATE

John G. Stockton, Marvin E. Bauer, Byron O. Blair, and Marion F. Baumgardner 1975 55 p refs
(Contracts NAS5-21785; NAS9-14016)
(NASA-CR-147405; LARS-Inform-Note-040775) Avail: NTIS HC $4.50 CSCL 02C

Crop identification using multispectral satellite imagery and multivariate pattern recognition was used to identify wheat accurately in Greeley County, Kansas. A classification accuracy of 97 percent was found for wheat and the wheat estimate in hectares was within 5 percent of the USDA's Statistical Reporting Service estimate for 1973. The multispectral response of cotton and sorghum in Texas was not unique enough to distinguish between them nor to separate them from other cultivated crops. Author

N76-15534*# Alabama Univ., University. Dept. of Geology and Geography.

ASSESSMENT OF PRACTICALITY OF REMOTE SENSING TECHNIQUES FOR A STUDY OF THE EFFECTS OF STRIP MINING IN ALABAMA Final Report, 1 Jul. 1973 - 30 Jun. 1975

Travis H. Hughes, Andrew C. Dillion, III, James R. White, Jr., S. E. Drummond, Jr., and W. Gary Hooks 30 Jun. 1975 190 p refs
(Contract NAS8-29936; Proj. 1-3-80-0084(1F))
(NASA-CR-144126) Avail: NTIS HC $7.50 CSCL 08I

Because of the volume of coal produced by strip mining, the proximity of mining operations, and the diversity of mining methods (e.g. contour stripping, area stripping, multiple seam stripping, and augering, as well as underground mining), the Warrior Coal Basin seemed best suited for initial studies on the physical impact of strip mining in Alabama. Two test sites, (Cordova and Searles) representative of the various strip mining techniques and environmental problems, were chosen for intensive studies of the correlation between remote sensing and ground truth data. Efforts were eventually concentrated in the Searles Area, since it is more accessible and offers a better opportunity for study of erosional and depositional processes than the Cordova Area. Author

N76-15535*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT US STANDARD CATALOG Monthly Report, 1 Nov. - 30 Nov. 1975

30 Nov. 1975 95 p
(NASA-TM-X-72952; GFSC/U-39; NTISUB/A/138-75/011)
Avail: NTIS HC $5.00; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

The U.S. Standard Catalog lists imagery of the continental U.S., Alaska and Hawaii acquired by Landsat 1 and 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N76-15536*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT NON-US STANDARD CATALOG Monthly Report, 1 Nov. - 30 Nov. 1975

30 Nov. 1975 74 p
(NASA-TM-X-72953; GSFC/N-39; NTISUB/A/139-75/011)
Avail: NTIS HC $4.50; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

The Non-U.S. Standard Catalog lists Non-U.S. imagery acquired by Landsat 1 and 2 which was processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found are also given. Author

N76-15537*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.

SKYLAB-4 VISUAL OBSERVATIONS PROJECT: GEOLOGICAL FEATURES OF SOUTHWESTERN NORTH AMERICA Final Report

Leon T. Silver 1 Nov. 1975 189 p
(Contract NAS9-13960)
(NASA-CR-147392) Avail: NTIS HC $7.50 CSCL 08G

Visual observations conducted by Skylab-4 crewmen on seven designated geological target areas and other targets of opportunity in parts of southwestern United States and northwestern Mexico were described. The experiments were designed to learn how effectively geologic features could be observed from orbit and what research information could be obtained from the observations when supported by ground studies. For the limited preparation they received, the crewmen demonstrated exceptional observational ability and produced outstanding photographic studies. They also formulated cogent opinions on how to improve future observational and photo-documentation techniques. From the photographs and other observations, it was possible to obtain

significant research contributions to on-going field investigations. These contributions were integrated into other aspects of the ground investigations to the following topics: major faults, regional stratigraphy, occurrence of Precambrian crystalline rocks, mapping of Mesozoic volcanic rocks, regional geology. Author

N76-15538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYTICAL APPLICATIONS OF BIOLUMINESCENCE AND CHEMILUMINESCENCE
Emmett W. Chappelle, ed. and Grace Lee Picciolo, ed. Washington 1975 119 p refs Presented at 2d Ann. Meeting of the Am. Soc. for Photobiology, Vancouver, British Columbia, 1974 (NASA-SP-388) Avail: NTIS HC $5.50 CSCL 06C

Bioluminescence and chemiluminescence studies were used to measure the amount of adenosine triphosphate and therefore the amount of energy available. Firefly luciferase - luciferin enzyme system was emphasized. Photometer designs are also considered. For individual titles, see N76-15539 through N76-15550.

N76-15539* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROBLEM AREAS IN THE USE OF THE FIREFLY LUCIFERASE ASSAY FOR BACTERIAL DETECTION
Grace Lee Picciolo, Emmett W. Chappelle, Elizabeth A. Knust (New England Medical Center, Boston), S. A. Tuttle (New England Medical Center, Boston), and C. A. Curtis (Hahnemann Medical Coll., Philadelphia) *In its* Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 1-26 refs (For availability see N76-15538 06-43)
CSCL 06M

By purifying the firefly luciferase extract and adding all necessary chemicals but ATP in excess, an assay for ATP was performed by measuring the amount of light produced when a sample containing soluble ATP is added to the luciferase reaction mixture. Instrumentation, applications, and basic characteristics of the luciferase assay are presented. Effect of the growth medium and length of time grown in this medium on ATP per viable E. coli values is shown in graphic form, along with an ATP concentration curve showing relative light units versus ATP injected. Reagent functions and concentration methods are explored. Efforts to develop a fast automatable system to detect the presence of bacteria in biological fluids, especially urine, resulted in the optimization of procedures for use with different types of samples. J.A.M.

N76-15540* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF CERTAIN EXTRACTING AGENTS FOR EXTRACTION OF ADENOSINE TRIPHOSPHATE (ATP) FROM MICROORGANISMS FOR USE IN THE FIREFLY LUCIFERASE ATP ASSAY
Elizabeth A. Knust (New England Medical Center, Boston), Emmett W. Chappelle, and Grace Lee Picciolo *In its* Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 27-34 refs (For availability see N76-15538 06-43)
CSCL 06C

Firefly luciferase ATP assay is used in clinical and industrial applications, such as determination of urinary infection levels, microbial susceptibility testing, and monitoring of yeast levels in beverages. Three categories of extractants were investigated for their extracting efficiency. They were ionizing organic solvents, nonionizing organic solvents, and inorganic acids. Dimethylsulfoxide and formamide represented the ionizing organic solvents, while n-butanol, chloroform, ethanol, acetone, and methylene chloride were used for the nonionizing organic solvents. Nitric acid and perchloric acid were chosen for the inorganic acids category. Pathogens were tested with each solvent. They included: Saccharomyces carlsbergensis, E. coli, Staphylococcus aureus, Klebsiella pneumoniae, Enterobacter species, Proteus mirabilis, Proteus vulgaris, Staphylococcus epidermidis, Streptococcus faecalis, Pseudomonas aeruginosa, and Candida albicans. These results are shown in graphic representations. J.A.M.

N76-15541* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF GROWTH PHASE AND MEDIUM ON THE USE OF THE FIREFLY ADENOSINE TRIPHOSPHATE (ATP) ASSAY FOR THE QUANTITATION OF BACTERIA
V. N. Bush (Delaware State Coll., Dover), Grace Lee Picciolo, and Emmett W. Chappelle *In its* Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 35-41 refs (For availability see N76-15538 06-43)
CSCL 06C

Luciferase assay for adenosine triphosphate (ATP) was used as a rapid method to determine the number of bacteria in a urine sample after nonbacterial components were removed. Accurate cellular ATP values, determined when bacteria were grown in an environment similar to that in which they were found, were necessary for the calculation of bacterial titer in urine. Cellular ATP values vary depending on the extraction method, the cell growth phase, and cell growth conditions. ATP per cell values of stationary E. coli grown in urine were two times greater than ATP per cell values of cells grown in trypticase soy broth. Glucose and urea were examined as possible components responsible for the cellular ATP variation. Author

N76-15542* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A RAPID METHOD FOR THE DETERMINATION OF MICROBIAL SUSCEPTIBILITY USING THE FIREFLY LUCIFERASE ASSAY FOR ADENOSINE TRIPHOSPHATE (ATP)
H. Vellend (New England Medical Center Hospital, Boston), S. A. Tuttle (New England Medical Center Hospital, Boston), M. Barza (New England Medical Center Hospital, Boston), L. Weinstein (New England Medical Center Hospital, Boston), Grace Lee Picciolo, and Emmett W. Chappelle *In its* Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 43-44 (For availability see N76-15538 06-43)
CSCL 06C

Luciferase assay for adenosine triphosphate (ATP) was optimized for pure bacteria in broth in order to evaluate if changes in bacterial ATP content could be used as a rapid measure of antibiotic effect on microorganisms. Broth cultures of log phase bacteria were incubated at 310 K (37 C) for 2.5 hours at antimicrobial concentrations which resulted in the best discrimination between sensitive and resistant strains. Eighty-seven strains of 11 bacterial species were studied for their susceptibility to 12 commonly used antimicrobial agents: ampicillin, Penicillin G, nafcillin, carbenicillin, cephalothin, tetracycline, erythromycin, clindamycin, gentamicin, nitrofurantoin, colistin, and chloramplenicol. The major advantage of the ATP system over existing methods of rapid microbial susceptibility testing is that the assay can be made specific for bacterial ATP. Author

N76-15543* Agriculture Dept., Beltsville, Md. Agricultural Research Service.
APPLICATION OF THE LUCIFERIN-LUCIFERASE ENZYME SYSTEM FOR DETERMINATION OF ADENOSINE TRIPHOSPHATE (ATP) TO STUDIES ON THE MECHANISMS OF HERBICIDE ACTION
J. B. St.John *In* NASA. Goddard Space Flight Center Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 45-48 refs (For availability see N76-15538 06-43)
CSCL 06C

The luciferin-luciferase enzyme system for determination of ATP is valuable for studies on the mechanisms of herbicide action. Investigations using this system have shown that certain herbicides may act by interfering with ATP production or by blocking ATP use, or by both mechanisms. Author

N76-15544* Oregon State Univ., Corvallis. Dept. of Crop Science.
BIOLUMINESCENCE FOR DETERMINING ENERGY STATE OF PLANTS
Te May Ching *In* NASA. Goddard Space Flight Center Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 49-56 refs (For availability see N76-15538 06-43)
CSCL 06C

Bioluminescence produced by the luciferin-luciferase system is a very sensitive assay for ATP content in extracts of plant materials. The ATP test for seed and pollen viability and vigor is presented, along with prediction of high growth potential and productivity in new crosses and selections of breeding materials.

ATP as an indicator for environmental quality, stresses, and metabolic regulation is also considered. J.A.M.

N76-15545* Johns Hopkins Univ., Baltimore, Md. Leonard Wood Memorial Leprosy Research Lab.
ULTRASENSITIVE BIOLUMINESCENT DETERMINATIONS OF ADENOSINE TRIPHOSPHATE (ATP) FOR INVESTIGATING THE ENERGETICS OF HOST-GROWN MICROBES
J. H. Hanks and A. M. Dhople *In* NASA. Goddard Space Flight Center Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 57-65 (For availability see N76-15538 06-43)
CSCL 06M

Stability and optimal concentrations of reagents were studied in bioluminescence assay of ATP levels. Luciferase enzyme was prepared and purified using Sephadex G-100. Interdependencies between enzyme and luciferin concentrations in presence of optimal Mg are illustrated. Optimal ionic strength was confirmed to be 0.05 M for the four buffers tested. Adapted features of the R- and H-systems are summarized, as well as the percentages of ATP pools released from representative microbes by heat and chloroform. J.A.M.

N76-15546* Johns Hopkins Univ., Baltimore, Md. Leonard Wood Memorial Leprosy Research Lab.
ENERGETICS OF THE HOST-DEPENDENT MYCOBACTERIUM LEPRAEMURIUM DURING TRANSITION TO A CAPACITY FOR EXTRACELLULAR GROWTH
A. M. Dhople and J. H. Hanks *In* NASA. Goddard Space Flight Center Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 67-73 (For availability see N76-15538 06-43)
CSCL 06M

The ATP measurements were refined to a point where the growth potential of microscopic samples of host-dependent microbes can be measured, even before an increase in microbial numbers has occurred. This tool differs from other biochemical indicators of physiologic states in its sensitivity and in the fact that it can be exploited with unwashed host-dependent and host-grown organisms. Author

N76-15547* California Univ., San Diego. Inst. of Marine Resources.
APPLICATIONS OF ADENINE NUCLEOTIDE MEASUREMENTS IN OCEANOGRAPHY
O. Holm-Hansen, R. Hodson, and F. Azam *In* NASA. Goddard Space Flight Center Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 75-87 refs (For availability see N76-15538 06-43)
(Contract AT(11-1)-GEN-10; Grants NSF GV-41705; NSF GX-39139)
CSCL 08A

The methodology involved in nucleotide measurements is outlined, along with data to support the premise that ATP concentrations in microbial cells can be extrapolated to biomass parameters. ATP concentrations in microorganisms and nucleotide analyses are studied. J.A.M.

N76-15548* Princeton Univ., N.J. Dept. of Biology.
SPECIFICITY OF AEQUORIN LUMINESCENCE TO CALCIUM
Osamu Shimomura and Frank H. Johnson *In* NASA. Goddard Space Flight Center Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 89-94 refs (For availability see N76-15538 06-43)
CSCL 06C

The presence of Pb(++), Co(++), Cu(++), and Cd(++), each of which possesses a certain luminescence-triggering activity of aequorin, potentially interferes with the specificity of the aequorin luminescence response to Ca(++). Interference by the above cations can be eliminated, without influencing the sensitivity of the luminescence of aequorin to Ca(++), by adding 1 mM of sodium diethyldithiocarbamate. Author

N76-15549* American Cyanamid Co., Bound Brook, N.J.
APPLICATIONS OF CHEMILUMINESCENCE TO BACTERIAL ANALYSIS
Norma D. Searle *In* NASA. Goddard Space Flight Center Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 95-103 refs (For availability see N76-15538 06-43)
CSCL 06M

Luminol chemiluminescence method for detecting bacteria was based on microbial activation of the oxidation of the luminol monoanion by hydrogen peroxide. Elimination of the prior lysing step, previously used in the chemiluminescence technique, was shown to improve considerably the reproducibility and accuracy of the method in addition to simplifying it. An inexpensive, portable photomultiplier detector was used to measure the maximum light intensity produced when the sample is added to the reagent. Studies of cooling tower water show that the luminol chemiluminescence technique can be used to monitor changes in viable cell population both under normal conditions and during chlorine treatment. Good correlation between chemiluminescence and plate counts was also obtained in the analysis of process water used in paper mills. This method showed good potential for monitoring the viable bacteria populations in activated sludge used in waste treatment plants to digest organic matter. J.A.M.

N76-15550* Georgia Univ., Athens. Bioluminescence Lab.
SIMPLE PHOTOMETER CIRCUITS USING MODULAR ELECTRONIC COMPONENTS
John E. Wampler *In* NASA. Goddard Space Flight Center Anal. Appl. of Bioluminescence and Chemiluminescence 1975 p 105-115 refs (For availability see N76-15538 06-43)
(Grant NSF GB-43804)
CSCL 06B

Operational and peak holding amplifiers are discussed as useful circuits for bioluminescence assays. Circuit diagrams are provided. While analog methods can give a good integration on short time scales, digital methods were found best for long term integration in bioluminescence assays. Power supplies, a general photometer circuit with ratio capability, and variations in the basic photometer design are also considered. J.A.M.

N76-15551*# Ohio State Univ. Research Foundation, Columbus.
ERROR ANALYSIS FOR THE PROPOSED CLOSE GRID GEODYNAMIC SATELLITE MEASUREMENT SYSTEM (CLOGEOS)
Ivan I. Mueller, B. H. W. VanGelder, and M. Kumar Sep. 1975 95 p refs
(Contract NAS8-31195; OSURF Proj. 4105-A1)
(NASA-CR-144133; Rept-230) Avail: NTIS HC $5.00 CSCL 08E

The close grid geodynamic measurement system experiment which envisages an active ranging satellite and a grid of retro-reflectors or transponders in the San Andreas fault area is a detailed simulated study for recovering the relative positions in the grid. The close grid geodynamic measurement system for determining the relative motion of two plates in the California region (if feasible) could be used in other areas of the world to delineate and complete the picture of crustal motions over the entire globe and serve as a geodetic survey system. In addition, with less stringent accuracy standards, the system would also find usage in allied geological and marine geodesy fields. Author

N76-15552*# Ecosystems International, Inc., Gambrills, Md.
USER REQUIREMENTS AND USER ACCEPTANCE OF CURRENT AND NEXT-GENERATION SATELLITE MISSION AND SENSOR COMPLEMENT, ORIENTED TOWARD THE MONITORING OF WATER RESOURCES Final Report, Jun. - Oct. 1975
Peter A. Castruccio, Harry L. Loats, Thomas R. Fowler, and Paul Robinson Dec. 1975 95 p refs
(Contract NAS5-20567)
(NASA-CR-144712; ECO-75:C-3-4) Avail: NTIS HC $5.00 CSCL 08H

Principal water resources users were surveyed to determine the applicability of remotely sensed data to their present and future requirements. Analysis of responses was used to assess the levels of adequacy of LANDSAT 1 and 2 in fulfilling hydrological functions, and to derive systems specifications for future water resources-oriented remote sensing satellite systems. The analysis indicates that water resources applications for all but the very large users require: (1) resolutions on the order of 15 meters, (2) a number of radiometric levels of the same order as currently used in LANDSAT 1 (64), (3) a number of spectral bands not in excess of those used in LANDSAT 1, and (4) a

repetition frequency on the order of 2 weeks. The users had little feel for the value of new sensors (thermal IR, passive and active microwaves). What is needed in this area is to achieve specific demonstrations of the utility of these sensors and submit the results to the users to evince their judgement. Author

N76-15553*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SATELLITE MICROWAVE OBSERVATIONS OF SOIL MOISTURE VARIATIONS

T. J. Schmugge, A. Rango, and R. Neff Nov. 1975 32 p refs (NASA-TM-X-71036; X-913-75-304) Avail: NTIS HC $4.00 CSCL 08M

The electrically scanning microwave radiometer (ESMR) on the Nimbus 5 satellite was used to observe microwave emissions from vegetated and soil surfaces over an Illinois-Indiana study area, the Mississippi Valley, and the Great Salt Lake Desert in Utah. Analysis of microwave brightness temperatures (T sub B) and antecedent rainfall over these areas provided a way to monitor variations of near-surface soil moisture. Because vegetation absorbs microwave emission from the soil at the 1.55 cm wavelength of ESMR, relative soil moistur3 measurements can only be obtained over bare or sparsely vegetated soil. In general T sub B increased during rainfree periods as evaporation of water and drying of the surface soil occurs, and drops in T sub B are experienced after significant rainfall events wet the soil. Microwave observations from space are limited to coarse resolutions (10-25 km), but it may be possible in regions with sparse vegetation cover to estimate soil moisture conditions on a watershed or agricultural district basis, particularly since daily observations can be obtained. Author

N76-15554*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPACEBORNE EARTH APPLICATIONS RANGING SYSTEM (SPEAR)

F. O. Vonbun, W. D. Kahn, P. D. Argentiero, D. W. Koch, and K. J. Eng (Computer Sci. Corp.) Dec. 1975 20 p refs Proposed for presentation at COSPAR 19th Plenary Meeting, Philadelphia, 8-19 Jun. 1976

(NASA-TM-X-71035; X-920-75-299) Avail: NTIS HC $3.50 CSCL 08G

A technique is discussed for the accurate (i.e. to within fractions of cm/yr) detection of earth surface motions utilizing the latest space technology. It is shown that over a six day period and assuming a 50% cloud cover (as experienced over the last few years of laser operation) utilizing spaceborne precision ranging systems, intersite distances on the order of 5 to 15 km can be determined in the vertical and horizontal components with errors in the 0.5 to 1.5 cm range. These errors are almost independent of ground survey errors up to 0.25 meters and orbit errors up to 200 meters. A spaceborne laser ranging system is assumed to range simultaneously to two or more ground emplaced retroreflectors. The fundamental advantage derived from simultaneous ranging is the elimination to first order of errors due to the system. This means elimination of bias errors in the ranging system, errors due to propagation effects, and errors associated with the spacecraft's motion in its orbit. Author

N76-15555*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POWER SPECTRA OF GEOID UNDULATIONS

Richard D. Brown Nov. 1975 21 p refs Submitted for publication

(NASA-TM-X-71028; X-921-75-300) Avail: NTIS HC $3.50 CSCL 08E

Data from spacecraft altimeters are expected to contribute to an improved determination of the marine geoid. To better define altimeter system design requirements for geoid recovery, amplitudes of geoid undulations at short wavelengths were examined. Models of detailed geoids in selected areas around the earth, developed from a combination of satellite derived spherical harmonics and 1 deg-by-1 deg area mean free-air gravity anomalies, were subjected to a spectral analysis. The resulting undulation power spectra were compared to existing estimates for the magnitude of geoid undulations at short wavelengths. The undulation spectra were found to be consistent with Kaula's rule of thumb, following an inverse third power relationship with spatial frequency for wavelengths at least as small as 300 km. The requirements imposed by this relationship on altimeter accuracy, data rate, and horizontal resolution to meet the goal of a detailed geoid description are discussed. Author

N76-15556*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EARTH AND OCEAN DYNAMICS SATELLITES AND SYSTEMS

F. O. Vonbun Nov. 1975 34 p refs Presented at Intern. Astronautical Federation (IAF) 26th Congr., Lisbon, 21-27 Sep. 1975

(NASA-TM-X-71026; X-900-75-287) Avail: NTIS HC $4.00 CSCL 08E

An overview is presented of the present state of satellite and ground systems making observations of the dynamics of the solid earth and the oceans. Emphasis is placed on applications of space technology for practical use. Topics discussed include: satellite missions and results over the last two decades in the areas of earth gravity field, polar motions, earth tides, magnetic anomalies, and satellite-to-satellite tracking; laser ranging systems; development of the Very Long Baseline Interferometer; and Skylab radar altimeter data applications. J.M.S.

N76-15557# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.

DEFINITION OF THE TECHNICAL REQUIREMENTS FOR AN EARTH RESOURCES PAYLOAD FOR THE SPACELAB (WITH RESPECT TO EUROPEAN USER REQUIREMENTS). FOLLOW-ON STUDY Final Report

31 Jul. 1974 120 p refs Original contains color illustrations (Contract ESA-SC/3/73-HQ)

(MBB-ERP-74/01; ESA-CR(P)-712) Avail: NTIS HC $5.50

Some special problem areas were investigated for the Spacelab earth resources payload's European user requirements. The generation of clear data for some typical orbit types with respect to ground coverage and measurement repetition in relation to agreed test sites is discussed. Operational areas time-lines, data, and power profiles for the different orbits are examined. The inclusion of an atmospheric sensor package as support and calibration sensors for remote sensing is studied, including some stratospheric and air quality measurements. Besides two additional orbits, a correlation is discussed between the orbit characteristics and the measurement conditions such as test site coverage, measurement repetition per day and per mission, and contact times under typical view angles. ESA

N76-15558# Environmental Research and Technology, Inc., Concord, Mass.

MAPPING OF SEA SURFACE TEMPERATURE BY THE DMSP SATELLITE Final Report

James L. Cogan and James H. Willand May 1975 83 p refs (EPRF Proj. 66856)

(AD-A014427; ERT-1065-F; EPRF-7-75(ERT)) Avail: NTIS CSCL 08/10

Sea surface temperature (T2) may be inferred from Defense Meteorological Satellite Program (DMSP) satellite measurements of infrared radiances in atmospheric windows if errors in instrumentation, data processing, and satellite orientation are properly accounted for. Even in the absence of clouds, the slight opacity of the atmosphere in the windows causes the temperature 'seen' by the satellite to be lower than that measured by ships or aircraft. Clouds produce the same effect, but generally of a greater magnitude. GRA

N76-15559# University of Southern Calif., Los Angeles. Dept. of Geological Sciences.

APPLICATIONS OF ERTS IMAGERY AND SHIPBOARD OBSERVATIONS TO COASTAL ENVIRONMENTS STUDIES. PART 1: HYPERSALINE ENVIRONMENTS. PART 2: COASTAL CIRCULATION ANALYSIS Final Technical Report, 1 Jan. - 31 Dec. 1974

Donn. S. Gorsline, Stephen P. VonderHaar, and Corla C. Davis Aug. 1975 45 p refs

(Contract N00014-67-A-0269-0009; NR Proj. 388-108)

(AD-A014570; USC-GEOL-76-1-Pt-1/2) Avail: NTIS CSCL 08/3

Work done during the 1974 included a study of the wetting

cycles on tidal and supra-tidal coastal areas of Baja California in arid climatic conditions. Progress on ERTS (LANDSAT) imagery analysis as a basis for describing coastal water circulation patterns includes collection of oceanographic data on water transparency and suspended sediment concentrations from shipboard on the date of satellite passage and comparison of patterns with general circulation as defined by standard oceanographic surveys (source data is from California Cooperative Fisheries Project and from field work aboard R. V. VELERO IV of the University of Southern California). Data show that the satellite imagery gives a higher degree of detail than the ship observations due to the time required for ship traverses and stations and the consequent limitations of resolution. GRA

N76-15560# Stanford Univ., Calif. Dept. of Industrial Engineering.

DEVELOPMENT OF A PROCEDURE FOR FORECASTING LONG RANGE ENVIRONMENTAL IMPACTS. REPORT TO THE RESOURCE AND LAND INVESTIGATIONS (RALI) PROGRAM, US GEOLOGICAL SURVEY

Benjamin Schlesinger and Douglas Daetz Aug. 1975 152 p refs

(Contract DI-14-08-0001-15105)

(PB-244974/2; SU-TR-75-3; USGS-LI-75/007) Avail: NTIS HC $6.75 CSCL 13B

A procedure for predicting long-range environmental impacts of large-scale project is presented along with an attempt to generate a consistent, systematic basis for comparing development alternatives. The methodology entails combining a schedule of primary environmental impacts expected as a result of future activities with a matrix of environmental factor relationships. Each term in this cross-impact matrix relates a change in one factor in one year to a change in another factor the following year by a linear multiplier. An extended version of the matrix is proposed that contains additional terms to reflect the impact of several environmental factors changing at the same time. Thus approximate forecasts for each of a set of environmental factors are produced that consider both direct and higher order impacts. GRA

N76-15561# Georgia Univ., Athens.

A MATHEMATICAL PROGRAMMING APPROACH TO PUBLIC WATER PROJECT PORTFOLIO SELECTION Ph.D. Thesis

Walter Poole Neely 1974 172 p refs

(PB-243844/8; W75-10131) Avail: NTIS HC $6.75 CSCL 13B

A model for selecting water resources projects for inclusion in portfolios of investment opportunities using mathematical programming techniques was developed and tested for several Tennessee Valley Authority projects. The portfolio approach was suggested as operationally superior to the independent project selection approach based on maximum benefit-cost ratio (BCR). The relationships of each project to each project and to the expected budgets are accounted for with the portfolio approach. The (integer) programming method was suggested as a more effective method of portfolio selection than ranking by the maximum BCR. The optimum portfolio solution differs from the BCR solution due both to the complexity of the water resources problem and to the inadequacy of the BCR criterion. GRA

N76-15562# Environmental Research Inst. of Michigan, Ann Arbor.

AN EXPERIMENT IN THE APPLICATION OF REMOTE SENSING TO LAND-USE PLANNING ON THE URBAN FRINGE Final Report, May 1971 - Jun. 1974

E. Perlman and R. K. Raney Jun. 1975 44 p refs

(Grant NSF GI-34809)

(PB-244517/9; ERIM-193500-6-F3; NSF/RA/E-75-038) Avail: NTIS HC $4.00 CSCL 13B

Major results and conclusions are presented for the effort to foster and test the use of a remote-sensing information system in the local land-use planning process. Remote-sensing flights over Vienna Township, Michigan were designed to provide imagery and quantitative data on land use and land-cover features in a developing rural-suburban area on the urban fringe. The particular township was chosen as a prototype of those areas bordering metropolitan centers, largely rural but increasingly suburban, which are confronted with the need to monitor and regulate the transition to expanded suburban and urban uses. GRA

N76-15563# Arizona Univ., Tucson. School of Renewable Natural Resources.

DEVELOPMENT OF A BIBLIOGRAPHIC INFORMATION SYSTEM FOR WATER YIELD IMPROVEMENT PRACTICES Project Completion Report, Jul. 1972 - Jun. 1975

Linda M. White, David B. Thorud, and Peter F. Ffolliott Aug. 1975 11 p refs

(Contract DI-14-31-0001-3803)

(PB-244699/1; W75-11050) Avail: NTIS HC $3.50 CSCL 13B

Development of the Watershed Management Information System (WAMIS) began in 1972. WAMIS is designed to serve a variety of users who are interested in water and natural resource research in Arizona. WAMIS is a computerized bibliographic reference retrieval system which provides literature searches for users, in the form of individualized computer printouts of citations and abstracts, based upon a user's special interests. The literature covered in WAMIS includes effects of land management practices and vegetation management on water and other related resources, such as forage production, wildlife habitat, timber production, and recreational use. Research done in Arizona was emphasized. General procedures used in banking and retrieval are described. Types of search requests have varied, including topics such as wildlife use of ponderosa pine forests, environmental and vegetation effects on evapotranspiration, hydrologic modeling, Arizona water quality data, the effect of timber cutting practices on runoff, and revegetation of treated pinyon-juniper vegetation. GRA

N76-15564# Resources for the Future, Inc., Washington, D.C.

RESOURCE TERMINOLOGY, AN EXAMINATION OF CONCEPTS AND TERMS AND RECOMMENDATIONS FOR IMPROVEMENT Final Report

J. J. Schanz Aug. 1975 131 p refs

(PB-244433/9; EPRI-336-FR) Avail: NTIS HC $6.00 CSCL 05B

This report is a comprehensive examination of terminology as it applies to resources in general and to energy in particular. A set of terms is not proposed but a potentially useful conceptual framework was examined as a basis for future action by those who must assume the responsibility for the specifics. The objective of this report is to review and evaluate what has been, or may be, accomplished by the adoption of new resources terminology by the Bureau of Mines and the Geological Survey. The evaluation invludes an examination of the ability of other segments of the federal government to join with the Bureau of Mines and Geological Survey in a common resource language and how the terminology of other groups involved in resource estimation relates to or conflicts with the federal terms. GRA

N76-15565# Central Intelligence Agency, McLean, Va. Office of Joint Computer Support.

GRAPHIC DATA PRESENTATION AND EDIT (GADPET) PROGRAM: A USER'S GUIDE

P. Frederic Stepler Aug. 1975 57 p

(PB-244906/4; CIA/CP-75/2; CIA/DF-75/002a) Avail: NTIS HC $4.50 CSCL 08B

The Graphic Data Presentation and Edit (GADPET) program is an IBM System 360 FORTRAN and Assembler Language program which was developed to allow the user to interactively display and edit map type data on the IBM 2250 cathode-ray-tube terminal. IBM's Graphic Support Package subroutines are used to interface with the IBM 2250. GAPET permits a number of map editing functions to be performed interactively such as combining two or more lines into a new line with proper direction, extending a line, deleting a complete line, deleting points from a line, adding points to a line, and constructing a new linz. The program was developed as an aid for creating World Data Banks of the AUTOMAP System. GRA

N76-15566# Central Intelligence Agency, McLean, Va. Office of Joint Computer Support.

ROTATE AND SCALE (ROTSAL) PROGRAM FOR CARTOGRAPHIC APPLICATION; PROGRAM DOCUMENTATION

P. Frederic Stepler Aug. 1975 61 p
(PB-244904/9; CIA/CP-75/1a; CIA/DF-75/001a) Avail: NTIS HC $4.50 CSCL 08B

The Rotate and Scale (ROTSAL) program is an IBM Systems 360 FORTRAN program for cartographic application which accepts as input the raw digitized x-y coordinate data, performs several automatic map editing functions, and outputs data in the Graphic Data Format. The program also allows for automatic I/O error recovery from illegal characters of incomplete records in the raw digitized map data. The Automatic Map Editing functions are: rotate the data through an angle determined by the position of the three corners of the map; scale (calibrate) the data from digitizer measurements; offset and shift the data to an origin of (0,0); eliminate duplicate points; check the distance between consecutive data points and either discard the point, or create additional points between the two values; close lines for islands and lakes; and allow for partial or complete deletion aid of a line. ROTSAL was developed as an aid for creating World Data Banks of the AUTOMAP System. GRA

N76-15567# Lewin and Associates, Inc., Washington, D.C.
REVIEW OF SECONDARY AND TERTIARY RECOVERY OF CRUDE OIL Final Report
Jun. 1975 126 p
(Contract DI-14-01-0001-2044)
(PB-244970/0; FEA/G-75/482) Avail: NTIS HC $6.00 CSCL 08I

Policy options are reviewed that could increase domestic crude oil production. The basic issue addressed is whether and to what extent, FEA should use its regulatory process to encourage investment in high recovery crude oil production technology that would contribute to the Nation's goal of domestic energy self sufficiency. Topics discussed include: technical review of primary/secondary/tertiary production; impact and expectations of enchanced recovery; objectives for an improved program of enhanced recovery; economics of enhanced recovery; policy alternative to handling enhanced recovery projects and expenses; and exempting from price controls production from high-cost exotic enhancement projects. GRA

N76-15568# Mitre Corp., McLean, Va.
RESOURCE AND LAND INVESTIGATIONS (RALI) PROGRAM: AN APPROACH TO ENVIRONMENTAL ASSESSMENT WITH APPLICATION TO WESTERN COAL DEVELOPMENT Final Report
A. Bisselle, A. Binder, R. Holberger, L. Morrow, and R. Pagano
Aug. 1975 617 p refs
(Contract DI-14-08-0001-15105)
(PB-244632/6; MTR-6988; USGS-LI-75/006) Avail: NTIS HC $16.25 CSCL 08I

Use of the coal reserves in the western part of the U.S. is considered a possible means of achieving a measure of energy self-sufficiency. In addition to strip mining, the development of western coal can include mine-mouth electricity generation or coal gasification as well as the shipment of energy via unit trains, slurry pipelines, or overhead transmission lines. An approach is described for evaluating the environmental impacts of the various coal-development projects. Each project is composed of a number of activities and the primary as well as high-order impacts of these activities are linked by means of key-word cross referencing. GRA

N76-15569# Bureau of Mines, Denver, Colo. Intermountain Field Operation Center.
THE RESERVE BASE OF COAL FOR UNDERGROUND MINING IN THE WESTERN UNITED STATES Information Circular, 1975
Thomas K. Matson and Doss H. White, Jr. Jul. 1975 242 p refs
(PB-244909/8; BM-IC-8678) Avail: NTIS HC $7.75 CSCL 08I

The coal reserve base in the Western United States is presented for coalbeds amenable to extraction by underground mining methods. The Federal Bureau of Mines has abstracted data on the quality and quantity of coal resources/reserves from numerous state and federal publications and modified such data as necessary to allow computer storage and retrieval. Tonnages are compiled by state, county, coalbed, and rank, and allotted to sulfur categories by statistical apportionment. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-15570 Missouri Univ., Columbia.
ANALOG TRANSMISSION LINE MODELS FOR POWER SYSTEMS Ph.D. Thesis
James Bernard Jennings 1975 149 p
Avail: Univ. Microfilms Order No. 76-1024

An analysis and an evaluation were made of power system transmission line models suitable for electronic analog transient network analyzers or simulators. Modal component models and their use in analog simulators was presented. A transmission line model which uses standard symmetrical component quantities is described along with the relationship between the symmetrical component model and modal components. An evaluation of the sectioned line and dominate pole-zero representations of component line models is presented. An accurate method of determining the time response of a transmission line to a switched input signal using a numerical Laplace transform inversion algorithm is described. The inversion algorithm is easily used and may be applied to a variety of transmission line problems. Dissert. Abstr.

N76-15571 Arizona Univ., Tucson.
A COMPUTERIZED INFORMATION SYSTEM ON THE IMPACTS OF COAL FIRED ENERGY DEVELOPMENT IN THE SOUTHWEST Ph.D. Thesis
David Warren Layton 1975 118 p
Avail: Univ. Microfilms Order No. 76-1602

A hybrid informatic system capable of communicating impact information derived from a variety of sources is described. Specifically, the system is able to either retrieve textual material stored in a base information file or to execute on-line simulation models and routines in order to describe environmental impacts. Interactions with the information system are performed at a remote computer terminal by an information specialist who, with the assistance of supporting documents, helps users select information of interest. Evaluation of the system was carried out by demonstrating it to prospective users from electric utilities, government agencies, and the interested public in Arizona. The response of the users to the system shows that this type of communications technology is a viable means of transmitting environmental information. The results of the evaluation also indicate that the system's usefulness is more likely to depend on its credibility than on its convenience and that computer models are an effective way of describing cumulative impacts caused by a series of power plants. Dissert. Abstr.

N76-15572 Missouri Univ., Columbia.
HYBRID SIMULATION OF POWER GENERATING AND TRANSFORMER UNITS FOR LONG TERM DYNAMIC STUDIES Ph.D. Thesis
Somchai Anguvorakul 1975 194 p
Avail: Univ. Microfilms Order No. 76-989

Specific design and analysis for the generation unit model and the transformer model are presented. The generating unit simulation includes detailed analog models of synchronous generators, boilers, turbines, exciters and digital models of automatic generation control and boiler systems. An analog model of a transformer, with different configurations, features series impedances, tap-changing and saturable shunt impedance characteristics was designed. The analog models were designed and built employing integrated circuit technology. This research

is directed toward faster-than-real-time hybrid simulation to study the steady state, the transient and the long term dynamic responses of a power system. Test results from the simulator are presented to verify the generator and transformer unit designs. Dissert. Abstr.

N76-15573*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CONTROL FOR NUCLEAR THERMIONIC POWER SOURCE
Patent Application
Craig D. Sawyer, inventor (to NASA) (JPL) Filed 17 Oct. 1975 22 p
(Contract NAS7-100)
(NASA-Case-NPO-13114-2; US-Patent-Appl-SN-634214) Avail: NTIS HC $3.50 CSCL 10B

A control system is presented for a thermionic reactor power source. It maintains a constant load voltage while minimizing emitter temperature variations, in spite of wide and sudden changes in load. The control system includes a neutron flux control circuit, and a separate variable gain power regulator that provides a constant voltage output to the load. The neutron flux control circuit compares the actual neutron flux to a linear function of current supplied by the thermionic converter of the reactor, and uses any difference as an error signal that drives a mechanism which alters the neutron flux. The variable gain regulator always draws enough current from the thermionic converter to supply the load with a constant voltage. Block diagrams of the system are shown. NASA

N76-15574*# General Atomic Co., San Diego, Calif.
STUDIES OF THE USE OF HIGH-TEMPERATURE NUCLEAR HEAT FROM AN HTGR FOR HYDROGEN PRODUCTION
D. D. Peterman, R. W. Fontaine, R. N. Quade, L. J. Halvers, and A. M. Jahromi 30 Sep. 1975 355 p refs
(Contract NAS3-18935)
(NASA-CR-134919; GA-A13391) Avail: NTIS HC $10.50 CSCL 10A

The results of a study which surveyed various methods of hydrogen production using nuclear and fossil energy are presented. A description of these methods is provided, and efficiencies are calculated for each case. The process designs of systems that utilize the heat from a general atomic high temperature gas cooled reactor with a steam methane reformer and feed the reformer with substitute natural gas manufactured from coal, using reforming temperatures, are presented. The capital costs for these systems and the resultant hydrogen production price for these cases are discussed along with a research and development program. For individual titles, see N76-15575 through N76-15586.

N76-15575* General Atomic Co., San Diego, Calif.
TECHNOLOGICAL ASSESSMENT OF SELECTED HYDROGEN PROCESSES
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 16 p (For availability see N76-15574 06-44)
CSCL 10A

The production of hydrogen by steam-methane reforming is discussed. Data cover production capacity, heat sources, reformer process conditions, shift conversion, and purification. E.H.W.

N76-15576* General Atomic Co., San Diego, Calif.
HYDROGEN FROM COAL
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 8 p (For availability see N76-15574 06-44)
CSCL 10A

Hydrogen production from coal by hydrogasification is described. The process involves the solubilization of coal to form coal liquids, which are hydrogasified to produce synthetic pipeline gas; steam reforming this synthetic gas by a nuclear heat source produces hydrogen. A description is given of the hydrogen plant, its performance, and its effect on the environment. E.H.W.

N76-15577* General Atomic Co., San Diego, Calif.
PRODUCTION OF HYDROGEN BY DIRECT GASIFICATION OF COAL WITH STEAM USING NUCLEAR HEAT
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 14 p (For availability see N76-15574 06-44)
CSCL 10A

Problems related to: (1) high helium outlet temperature of the reactor, and (2) gas generator design used in hydrogen production are studied. Special attention was given to the use of Oklahoma coal in the gasification process. Plant performance, operation, and environmental considerations are covered. E.H.W.

N76-15578* General Atomic Co., San Diego, Calif.
HYDROGEN MANUFACTURE BY LURGI GASIFICATION OF OKLAHOMA COAL
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 14 p (For availability see N76-15574 06-44)
CSCL 10A

Advantages and disadvantages of using the Lurgi gasification process to produce hydrogen from Oklahoma coal are listed. Special attention was given to the production of heat for the process; heat is generated by burning part of pretreated coal in the steam generator. Overall performance of the Lurgi process is summarized in tabular form. E.H.W.

N76-15579* General Atomic Co., San Diego, Calif.
HYDROGEN BY ELECTROLYSIS OF WATER
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 14 p (For availability see N76-15574 06-44)
CSCL 10A

Hydrogen production by electrolytic decomposition of water is explained. Power efficiency, efficient energy utilization, and costs were emphasized. Four systems were considered: two were based on current electrolyzer technology using present efficiency values for electrical generation by fossil fired and nuclear thermal stations, and two using projected electrolyzer technology with advanced fossil and nuclear plants. E.H.W.

N76-15580* General Atomic Co., San Diego, Calif.
ISPRA MARK-10 WATER SPLITTING PROCESS
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 52 p refs (For availability see N76-15574 06-44)
CSCL 10A

A thermochemical water splitting process, the Ispra Mark-10 chemical reaction cycle, was chosen for examining the possibility of using water to produce hydrogen on a large scale for fuel and major industrial chemical uses. The assumed energy source for the process is an HTGR (helium cooled). A process flow diagram, a material balance, and an energy balance were developed for the thermochemical reaction cycle. Principal reactions which constitute the cycle are included. Author

N76-15581* General Atomic Co., San Diego, Calif.
HYDROGEN MARKET SURVEY
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 16 p (For availability see N76-15574 06-44)
CSCL 10A

Summary tables are given for the domestic consumption of hydrogen. Data cover chemicals, refinery operations, steelmaking, and synthetic fuels. Data show major consumption to be in the area of synthetic fuel production from coal and oil shale. Author

N76-15582* General Atomic Co., San Diego, Calif.
PROCESS DESCRIPTION
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 96 p ref (For availability see N76-15574 06-44)
CSCL 10A

The production of hydrogen from coal by hydrogasification and subsequent steam hydrocarbon reforming was studied. Process heat and power requirements are supplied by an HTGR. The process is examined as a function of a maximum reforming (process) temperature of 922 K (1200 F) to 1367 K (2000 F). The major parameters for the five cases selected are summarized in a table. A fixed thermal capacity of 3000 MW for the HTGR heat source was used as a basis. The resulting hydrogen production

rates and the corresponding hydrogen purity are also given in a table. Author

N76-15583* General Atomic Co., San Diego, Calif.
CAPITAL COST ESTIMATE
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 17 p refs (For availability see N76-15574 06-44)
CSCL 10A

The capital cost estimate for the nuclear process heat source (NPHS) plant was made by: (1) using costs from the current commercial HTGR for electricity production as a base for items that are essentially the same and (2) development of new estimates for modified or new equipment that is specifically for the process heat application. Results are given in tabular form and cover the total investment required for each process temperature studied. Author

N76-15584* General Atomic Co., San Diego, Calif.
ECONOMICS
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 17 p ref (For availability see N76-15574 06-44)
CSCL 10A

Tables covering the selling price of hydrogen as a function of each process temperature studied are presented. Estimated selling price, based on capital costs and operating and maintenance costs, is included. In all cases, no credit was given for the methane component of hydrogen. Author

N76-15585* General Atomic Co., San Diego, Calif.
ENVIRONMENTAL CONSIDERATIONS
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 15 p refs (For availability see N76-15574 06-44)
CSCL 10A

A comparison was made between the environmental impact of the present nuclear-heated process and the currently commercial hydrogen-producing process utilizing coal for heating, i.e., the Lurgi coal gasification process. This comparison is based on the assumption that both plants produce the same quantity of H2, i.e., 269 cu m/sec of approximately the same purity, that all pollution abatement equipment is of the same design and efficiency for both the Lurgi process and the nuclear process, and that the energy required for the fresh nuclear fuel and the fuel recycle is generated in a power plant which is also provided with pollution abatement equipment. The pollution caused by the auxiliary units is also taken into account. As regards process water usage, the data show that the water required for the nuclear route, including the nuclear fuel production, is approximately 78% of that required for the Lurgi route. Author

N76-15586* General Atomic Co., San Diego, Calif.
TECHNOLOGY ASSESSMENT
In its Studies of the Use of High-Temp. Nucl. Heat from an HTGR for Hydrogen Production 30 Sep. 1975 13 p ref (For availability see N76-15574 06-44)
CSCL 10A

The effects of process temperature (reforming temperature) on the overall hydrogen production process were examined. These effects are principally confined to the hydrogen production and the hydrogen purification processing units. Author

N76-15587*# Alabama Univ., Huntsville. Center for Environmental and Energy Studies.
SOLAR HEATING AND COOLING: TECHNICAL DATA AND SYSTEMS ANALYSIS Progress Report, Oct. 1974 - Aug. 1975
D. L. Christensen Sep. 1975 67 p refs
(Contract NAS8-31293)
(NASA-CR-144110) Avail: NTIS HC $4.50 CSCL 10A

The solar energy research is reported including climatic data, architectural data, heating and cooling equipment, thermal loads, and economic data. Lists of data sources presented include: selected data sources for solar energy heating and cooling; bibliography of solar energy, and other energy sources; sources for manufacturing and sales, solar energy collectors; and solar energy heating and cooling projects. F.O.S.

N76-15588*# Alabama Univ., Huntsville. Center for Environmental and Energy Studies.
SOLAR HEATING AND COOLING: TECHNICAL DATA AND SYSTEMS ANALYSIS. PRESENTATION CHARTS (BRIEFING TO NASA 17 SEPTEMBER 1975) Interim Status Report, Oct. 1974 - Aug. 1975
Sep. 1975 30 p
(Contract NAS8-31293)
(NASA-CR-144111) Avail: NTIS HC $4.00 CSCL 10A

An interim status briefing concerning the solar energy research is presented. Systems planning, methodology and procedures, which might be applied to the current program are included. F.O.S.

N76-15589*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
SOLAR CELLS FOR TERRESTRIAL APPLICATIONS Final Technical Report, 1 Jun. 1974 - 31 May 1975
Fred Chernow 31 May 1975 26 p refs
(Grant NsG-1027)
(NASA-CR-146065) Avail: NTIS HC $4.00 CSCL 10A

The power efficiency curves of photovoltaic solar cells were investigated as a function of the forbidden energy gap (E sub g) and the current-voltage characteristic of the diode. Minority carrier injection, depletion layer recombination, and interface recombination terms were considered in models for the I-V characteristic. The collection efficiency for photons with energy between (E sub g) and an upper energy cutoff (E sub w) was assumed to be 100% and zero otherwise. Results are presented in terms of a single parameter related to the ratio of depletion layer width and minority carrier diffusion length. It was found that increasing depletion layer recombination shifts the efficiency curves to larger values of the energy without changing the shape of the efficiency curve appreciably. It is believed that similar results would be obtained whenever the quality factors in the exponential energy gap and forward bias terms are equal. Author

N76-15590*# Institute of Gas Technology, Chicago, Ill.
SURVEY OF HYDROGEN PRODUCTION AND UTILIZATION METHODS. VOLUME 1: EXECUTIVE SUMMARY Final Report
Derek P. Gregory, Jon B. Pangborn, and Jay C. Gillis Aug. 1975 41 p
(Contract NAS8-30757)
(NASA-CR-144127) Avail: NTIS HC $4.00 CSCL 10B

The use of hydrogen as a synthetic fuel is considered. Processes for the production of hydrogen are described along with the present and future industrial uses of hydrogen as a fuel and as a chemical feedstock. Novel and unconventional hydrogen-production techniques are evaluated, with emphasis placed on thermochemical and electrolytic processes. Potential uses for hydrogen as a fuel in industrial and residential applications are identified and reviewed in the context of anticipated U.S. energy supplies and demands. A detailed plan for the period from 1975 to 1980 prepared for research on and development of hydrogen as an energy carrier is included. Author

N76-15591*# Institute of Gas Technology, Chicago, Ill.
SURVEY OF HYDROGEN PRODUCTION AND UTILIZATION METHODS. VOLUME 2: DISCUSSION Final Report
Jay C. Gillis, Derek P. Gregory, and Jon B. Pangborn Aug. 1975 477 p refs
(Contract NAS8-30757)
(NASA-CR-144128) Avail: NTIS HC $12.50 CSCL 10B
For abstract, see N76-15590.

N76-15592*# Institute of Gas Technology, Chicago, Ill.
SURVEY OF HYDROGEN PRODUCTION AND UTILIZATION METHODS. VOLUME 3: APPENDIXES Final Report
Jay C. Gillis, Hansraj C. Maru, and John C. Sharer Aug. 1975 194 p refs
(Contract NAS8-30757)
(NASA-CR-144129) Avail: NTIS CSCL 10B
For abstract, see N76-15590.

N76-15593*# Solarex Corp., Rockville, Md.
DEVELOPMENT OF A HIGH EFFICIENCY THIN SILICON SOLAR CELL Quarterly Report

Joseph Lindmayer Dec. 1975 20 p Prepared for JPL
(Contracts NAS7-100; JPL-954290)
(NASA-CR-146080; QR-1; SX/105/1Q) Avail: NTIS HC $3.50 CSCL 10A

Variations in temperatures used in experimental processing and their effect on the resulting solar cell performance parameters were investigated. Diffusion temperature variation results in a fairly distinct optimum cell performance for diffusion temperatures in the immediate vicinity of 850 C. An additional effort was also devoted to redesign of the matallization gridline pattern for both minimum light blockage and minimum fill factor alteration due to series resistance. Efforts on improvement of tantalum oxide antireflection coatings were undertaken. Fifty 2 cm x 2 cm cells having a range of thicknesses have been submitted as the first sample group. These cells were processed under conditions tentatively identified during this first contractual quarter's experiments as being optimal for resulting cell performance.
Author

N76-15594*# Raytheon Co., Sudbury, Mass. Equipment Div.
MICROWAVE POWER TRANSMISSION SYSTEM STUDIES. VOLUME 1: EXECUTIVE SUMMARY
O. E. Maynard, W. C. Brown, A. Edwards, G. Meltz, J. T. Haley, J. M. Howell, and A. Nathan (Grumman Aerospace Corp., Bethpage, N. Y.) Dec. 1975 231 p refs
(Contract NAS3-17835)
(NASA-CR-134886-Vol-1; ER75-4368-Vol-1) Avail: NTIS HC $8.00 CSCL 10B

A study of microwave power generation, transmission, reception and control was conducted as a part of a program to demonstrate the feasibility of power transmission from geosynchronous orbit. A summary is presented of results concerning design approaches, estimated costs (ROM), critical technology, associated ground and orbital test programs with emphasis on dc to rf conversion, transmitting antenna, phase control, mechanical systems, flight operations, ground power receiving-rectifying antenna with systems analysis, and evaluation. Recommendations for early further in-depth studies complementing the technology program are included. Author

N76-15595*# Raytheon Co., Sudbury, Mass. Equipment Div.
MICROWAVE POWER TRANSMISSION SYSTEM STUDIES. VOLUME 2: INTRODUCTION, ORGANIZATION, ENVIRONMENTAL AND SPACEBORNE SYSTEMS ANALYSES
O. E. Maynard, W. C. Brown, A. Edwards, J. T. Haley, G. Meltz, J. M. Howell, and A. Nathan (Grumman Aerospace Corp., Bethpage, N. Y.) Dec. 1975 262 p refs
(Contract NAS3-17835)
(NASA-CR-134886-Vol-2; ER75-4368-Vol-2) Avail: NTIS HC $9.00 CSCL 10B

Introduction, organization, analyses, conclusions, and recommendations for each of the spaceborne subsystems are presented. Environmental effects - propagation analyses are presented with appendices covering radio wave diffraction by random ionospheric irregularities, self-focusing plasma instabilities and ohmic heating of the D-region. Analyses of dc to rf conversion subsystems and system considerations for both the amplitron and the klystron are included with appendices for the klystron covering cavity circuit calculations, output power of the solenoid-focused klystron, thermal control system, and confined flow focusing of a relativistic beam. The photovoltaic power source characteristics are discussed as they apply to interfacing with the power distribution flow paths, magnetic field interaction, dc to rf converter protection, power distribution including estimates for the power budget, weights, and costs. Analyses for the transmitting antenna consider the aperture illumination and size, with associated efficiencies and ground power distributions. Analyses of subarray types and dimensions, attitude error, flatness, phase error, subarray layout, frequency tolerance, attenuation, waveguide dimensional tolerances, mechanical including thermal considerations are included. Implications associated with transportation, assembly and packaging, attitude control and alignment are discussed. The phase front control subsystem, including both ground based pilot signal driven adaptive and ground command approaches with their associated phase errors, are analyzed. Author

N76-15596*# Raytheon Co., Sudbury, Mass. Equipment Div.
MICROWAVE POWER TRANSMISSION SYSTEM STUDIES. VOLUME 3, SECTION 8: MECHANICAL SYSTEMS AND FLIGHT OPERATIONS
O. E. Maynard, W. C. Brown, A. Edwards, J. T. Haley, G. Meltz, J. M. Howell, and A. Nathan (Grumman Aerospace Corp., Bethpage, N. Y.) Dec. 1975 234 p refs
(Contract NAS3-17835)
(NASA-CR-134886-Vol-3; ER75-4368-Vol-3) Avail: NTIS HC $8.00 CSCL 10B

The efforts and recommendations associated with preliminary design and concept definition for mechanical systems and flight operations are presented. Technical discussion in the areas of mission analysis, antenna structural concept, configuration analysis, assembly and packaging with associated costs are presented. Technology issues for the control system, structural system, thermal system and assembly including cost and man's role in assembly and maintenance are identified. Background and desired outputs for future efforts are discussed. Author

N76-15597*# Raytheon Co., Sudbury, Mass. Equipment Div.
MICROWAVE POWER TRANSMISSION SYSTEM STUDIES. VOLUME 4: SECTIONS 9 THROUGH 14 WITH APPENDICES
O. E. Maynard, W. C. Brown, A. Edwards, J. T. Haley, G. Meltz, J. M. Howell, and A. Nathan (Grumman Aerospace Corp., Bethpage, N. Y.) Dec. 1975 235 p refs
(Contract NAS3-17835)
(NASA-CR-134886-Vol-4; ER75-4368-Vol-4) Avail: NTIS HC $8.00 CSCL 10B

The microwave rectifier technology, approaches to the receiving antenna, topology of rectenna circuits, assembly and construction, ROM cost estimates are discussed. Analyses and cost estimates for the equipment required to transmit the ground power to an external user. Noise and harmonic considerations are presented for both the amplitron and klystron and interference limits are identified and evaluated. The risk assessment discussion is discussed wherein technology risks are rated and ranked with regard to their importance in impacting the microwave power transmission system. The system analyses and evaluation are included of parametric studies of system relationships pertaining to geometry, materials, specific cost, specific weight, efficiency, converter packing, frequency selection, power distribution, power density, power output magnitude, power source, transportation and assembly. Capital costs per kW and energy costs as a function of rate of return, power source and transportation costs as well as build cycle time are presented. The critical technology and ground test program are discussed along with ROM costs and schedule. The orbital test program with associated critical technology and ground based program based on full implementation of the defined objectives is discussed. Author

N76-15598*# Raytheon Co., Sudbury, Mass. Equipment Div.
RECEPTION-CONVERSION SUBSYSTEM (RXCV) FOR MICROWAVE POWER TRANSMISSION SYSTEM Final Report
1 Sep. 1975 308 p refs
(Contracts NAS7-100; JPL-953968)
(NASA-CR-145917; ER75-4386) Avail: NTIS HC $9.75 CSCL 10B

As part of a program to demonstrate the feasibility of power transmission from space, an approximately 25 sq m Reception-Conversion Subsystem was designed and tested. The device collects high power microwave energy, converts it into dc, and dissipates it in an instrumented demonstration load. Author

N76-15599*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
STUDIES OF THE USE OF HEAT FROM HIGH TEMPERATURE NUCLEAR SOURCES FOR HYDROGEN PRODUCTION PROCESSES
G. H. Farbman Jan. 1976 328 p refs
(Contract NAS3-18934)
(NASA-CR-134918) Avail: NTIS HC $10.00 CSCL 10B

Future uses of hydrogen and hydrogen production processes that can meet the demand for hydrogen in the coming decades were considered. To do this, a projection was made of the market for hydrogen through the year 2000. Four hydrogen production processes were selected, from among water electrolysis, fossil based and thermochemical water decomposition systems, and evaluated, using a consistent set of ground rules, in terms of

relative performance, economics, resource requirements, and technology status. Author

N76-15600# Committee on Interior and Insular Affairs (U. S. Senate).
FACTORS AFFECTING COAL SUBSTITUTION FOR OTHER FOSSIL FUELS IN ELECTRIC POWER PRODUCTION AND INDUSTRIAL USES
Allen F. Agnew and David E. Gushee Washington GPO 1975 50 p refs Background paper pursuant to S. Res. 45 for Comm. on Interior and Insular Affairs, 94th Congr., 1st Sess., 1975 Prepared by the Library of Congr., Congressional Res. Service (GPO-52-490) Avail: US Capitol, Senate Document Room

The impediments to greater utilization of coal involve basic questions of industrial and national policy. The mining industry must invest large quantities of capital, adapt to new health, safety, and environmental protection requirements, develop and practice new mining technology, and move on a large scale into new geographical areas. The railroad and barge industries must expand their capacities, improve their facilities, and maximize the use of their stock. To meet these requirements, there must be assured markets of known dimensions. The utilities industry in particular is facing uncertainties regarding: (1) the availability of coal with the necessary distribution of sulfur, (2) the stringency of air quality standards, (3) Federal requirements for continuous sulfur oxide emission reductions, (4) oil price levels, and (5) the rapidity of the rise in demand for electricity in the face of higher rates. Steps must be taken to clarify these issues if coal is to be utilized more fully. Author

N76-15601# Committee on Interior and Insular Affairs (U. S. House).
OVERSIGHT HEARINGS ON NUCLEAR ENERGY: OVERVIEW OF THE MAJOR ISSUES, PART 1
Washington GPO 1975 907 p refs Hearings before Subcomm. on Energy and the Environment of Comm. on Interior and Insular Affairs, 94th Congr., 1st Sess., 28-29 Apr., 1-2 May 1975
(GPO-52-367) Avail: Subcomm. on Energy and the Environment

Testimony is presented on the advantages and disadvantages of further development of nuclear energy as a means of meeting national energy requirements. Factors considered include: the regulatory process; reactor safety; long-term nuclear waste disposal; costs; and solar energy as an alternative to nuclear energy. J.M.S.

N76-15602# Committee on Interstate and Foreign Commerce (U. S. House).
ENERGY CONSERVATION AND OIL POLICY, PART 1
Washington GPO 1975 1113 p refs Hearings on Titles 2, 3, 4, 12 and 13 of H.R. 2633, identical Bill H.R. 2650, and H.R. 2151 before Subcomm. On Energy and Power of Comm. on Interstate and Foreign Commerce, 94th Congr., 1st Sess., 10-14 Mar., 17-21 Mar., and 7 May 1975
(GPO-53-518) Avail: SOD HC $8.45

Testimony is presented on methods by which domestic energy supplies can be increased and energy demand decreased. Various means of preparing for energy emergencies are discussed along with the problem of imported oil and dollar outflow. J.M.S.

N76-15603*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELECTIVE COATING FOR SOLAR PANELS Patent Application
Glen E. McDonald, inventor (to NASA) Filed 22 Dec. 1975 12 p
(NASA-Case-LEW-12159-1; US-Patent-Appl-SN-643041) Avail: NTIS HC $3.50 CSCL 10A

A black chrome coating of controlled thickness (0.5 micron to 2.5 microns) which has improved energy absorbing properties is examined. The coating is deposited on a specially prepared metal substrate, and has high absorptivity for visible solar radiation, and low emissivity for infrared radiation. NASA

N76-15604*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS Executive Report
Ralph Lutwack 15 Oct. 1974 62 p refs Workshop Conf. held at Cherry Hill, N. J., 23-25 Oct. 1973 Sponsored by NASA
(Grant NSF AG-485)
(NASA-CR-145966; NSF/RA/N-74-073; PB-242529/6; JPL-SP-43-12) Avail: NTIS HC $4.50 CSCL 10B

This report is composed of a general overview of the Workshop Proceedings and deals primarily with the sections which treat the problems of using a photovoltaic conversion device for terrestrial applications. Topic areas covered include: single-crystal Si solar cell; CdS/Cu2S solar cell; other materials and devices insolation, testing, and systems. GRA

N76-15605# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
SOLAR THERMAL ELECTRIC POWER SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY Final Report
Nov. 1974 49 p refs Prepared in cooperation with Westinghouse Electric Corp., Pittsburgh, Pa.
(Grant NSF GI-37815)
(PB-243835/6; NSF/RANN/SE/GI-37815/FR-74-3; NSF/RA/N-74-196-Vol-1) Avail: NTIS HC $4.00 CSCL 10B

Design parameters are developed of systems for thermal/mechanical conversion of solar energy to electric power at minimum cost per kilowatt-hour generated. Systems of 3MW to 300MW sizes in a public utility network are considered. The three basic plant concepts considered for preliminary evaluation are: (1) a nonfocusing collector system using pressurized water at a temperature of 150C; (2) a line-focusing collector system using steam transport at 250C; and (3) a multiple tower/heliostat system generating steam at a temperature of 350C. Sketches of solar thermal power plant configurations and concepts of some components are shown. GRA

N76-15606# Colorado State Univ., Fort Collins.
SOLAR THERMAL ELECTRIC POWER SYSTEMS. VOLUME 2: SYSTEMS STUDIES AND ECONOMIC EVALUATIONS
Nov. 1974 235 p refs Prepared in cooperation with Westinghouse Electric Corp., Pittsburgh, Pa.
(Contract NSF GI-37815)
(PB-243836/4; NSF/RANN/SE/GI-37815/FR-74-3; NSF/RA/N-74-197-Vol-2) Avail: NTIS HC $8.00 CSCL 10B

Parametric performance and cost models are derived for key elements of the systems. A sequential optimization program was developed using these models to determine optimum subsystem sets and combinations which yield the least capital cost plants. A dynamic simulation program was developed to determine annual electric power produced by solar power systems at specific locations. Electric energy cost comparisons are made to select promising systems for generation of electricity from solar energy. GRA

N76-15607# Colorado State Univ., Fort Collins.
SOLAR THERMAL ELECTRIC POWER SYSTEMS. VOLUME 3: APPENDICES Final Report
Nov. 1974 639 p refs Prepared in cooperation with Westinghouse Electric Corp., Pittsburgh, Pa.
(Grant NSF GI-37815)
(PB-243837/2; NSF/RANN/SE/GI-37815/FR-74-3; NSF/RA/N-74-198-Vol-3) Avail: NTIS HC $16.25 CSCL 10B

For abstract, see N76-15605.

N76-15608# United States-Israel Binational Science Foundation.
HYDROPOWER STATIONS. GENERATING EQUIPMENT AND ITS INSTALLATION
A. N. Goncharov 1975 374 p refs Transl. into ENGLISH of the book "Gidroelektricheskoe oborudovanie gidroelektrostantsii i ego montazh" Moscow, Th. Pelz, 1972 Sponsored in part by NSF
(TT-74-50023; ISBN-0-7065-1497-1) Avail: NTIS HC $10.50

Hydropower sets are described. Fundamental concepts concerning the use of hydraulic energy are explained, as are the general theory of hydraulic turbines, their layout and design, the design of hydropower generators, governors, and the general equipment of hydroelectric power plants. A detailed discussion of installation work involving waterpower equipment is presented. GRA

N76-15609# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.
ROCHESTER GAS AND ELECTRIC CORPORATION STERLING POWER PROJECT NUCLEAR UNIT NO. 1. DOCKET NUMBER STN-50-485 Safety Evaluation Report
5 Sep. 1975 194 p refs
(PB-244613/6; NUREG-75/082) Avail: NTIS HC $7.50 CSCL 18E

A safety evaluation of the proposed Sterling Power Project, located in Cayuga County, New York, was prepared. The evaluation consists of a technical review and staff evaluation of applicant information on the following subjects: (1) Population density, land use, and physical characteristics of the site area; (2) design, fabrication, construction, testing criteria, quality assurance program, and performance characteristics of plant structures, systems, and components important to safety; (3) expected response of the facility to anticipated operating transients, and to postulated design basis accidents; (4) applicant engineering and construction organization, and plans for the conduct of plant operations; and (5) design criteria for a system to control the plant's radiological effluents. GRA

N76-15610# Nuclear Regulatory Commission, Washington, D.C.
CONSTRUCTION OF WOLF CREEK GENERATING STATION, UNIT NO. 1, KANSAS GAS AND ELECTRIC COMPANY, KANSAS CITY POWER AND LIGHT COMPANY. DOCKET NO. STN-50-482 Safety Evaluation Report
3 Sep. 1975 193 p refs
(PB-244655/7; NUREG-75/080) Avail: NTIS HC $7.50 CSCL 18E

A safety evaluation for a license to construct and operate the proposed Wolf Creek Generating Station, located in Coffey County, Kansas, was prepared. The evaluation consists of a technical review and staff evaluation of applicants' information on the following subjects: (1) population density, land use, and physical characteristics of the site area; (2) design, fabrication, construction, testing criteria, quality assurance program, and performance characteristics of plant structures, systems, and components important to safety; (3) expected response of the facility to anticipate operating transients, and to postulated design basis accidents; (4) Kansas G and E engineering and construction organization, and plans for the conduct of plant operations; and (5) design criteria for a system to control the plant's radiological effluents. GRA

N76-15611# Cornell Univ., Ithaca, N.Y.
PROCEEDINGS OF THE CORNELL INTERNATIONAL SYMPOSIUM AND WORKSHOP ON THE HYDROGEN ECONOMY
Simpson Linke Apr. 1975 443 p refs Proc. held at Ithaca, N. Y., 20-22 Aug. 1973 Sponsored by NSF
(PB-244394/3; NSF/RA/N-75-062) Avail: NTIS HC $11.75 CSCL 21D

This document contains the proceedings of a symposium on the hydrogen energy economy conducted at Cornell University in August, 1973. The participants included both advocates and skeptics, so that the principles in each camp would have direct intellectual contact in order to achieve a better understanding of the potential of the hydrogen economy, either pro or con. Both viewpoints are amply represented in these proceedings. Alternate proposals such as the all electric economy and the methanol economy are also included. The issue of hydrogen economics remains uncertain despite the attention given it during the conference, but the continuing high cost of fossil fuels will make hydrogen economically feasible sooner than any participant would have dared to predict in 1973. Subjects covered here include the following: an overview of the hydrogen economy, hydrogen production and economics, energy transmission and storage, thermochemical means of producing hydrogen, electrochemical problems of the hydrogen economy, hydrogen in the marketplace, prospects for hydrogen utilization, and the impact of hydrogen on transportation. GRA

N76-15612# Eagle-Picher Co., Joplin, Mo. Couples Dept.
NON-HAZARDOUS PRIMARY LITHIUM ORGANIC ELECTROLYTE BATTERIES Final Report, 20 Jun. 1973 - 30 Mar. 1975
J. Giltner Jul. 1975 51 p
(Contract DAAB07-73-C-0269)
(AD-A014066; ECOM-73-0269-F) Avail: NTIS CSCL 10/3

This report describes the design and testing of the BA-5590()/U which is a primary, lithium-organic electrolyte battery. The intent of the program is the development of a battery which will be rendered safe under various severe conditions of storage, use and disposal. GRA

N76-15613# Federal Energy Administration, Washington, D.C. Office of Energy Resource Development.
TRENDS IN REFINERY CAPACITY AND UTILIZATION, PETROLEUM REFINERIES IN THE UNITED STATES-FOREIGN REFINERY EXPORTING CENTERS Annual Report
Eugene Peer Jun. 1975 45 p
(PB-244093/1; FEA/G-75/368) Avail: NTIS HC $4.00 CSCL 07A

Estimates of U.S. petroleum refinery capacity growth in 1975 are examined. Included in the study are: (1) refining capacities as of January 1, 1960-1980; (2) new refineries, expansions, and reactivations; (3) revised summary of 1974 U.S. refinery capacity; (4) U.S. refineries planned but not constructed due to opposition on environmental grounds; and (5) world refining/export centers downstream equipment. The study also analyzes world refining exporting centers in the Bahamas/Caribbean, the Middle East, Eastern Canada, Italy, and Singapore, including petroleum product exports from those countries to the U.S. and a survey of current capacity and future firm projects in the above countries. GRA

N76-15614# Federal Energy Administration, Washington, D.C. Office of Energy Statistics.
ENERGY INFORMATION REPORTED TO CONGRESS AS REQUIRED BY PUBLIC LAW 93-319 Quarterly Report, Jul. - Sep. 1974
Dec. 1974 155 p refs
(PB-244605/2; FEA/C-75/173; QR-3) Avail: NTIS HC $6.75 CSCL 10A

Summaries and statistical tables are given for the quarter on resource development and production, consumption, storage, distribution, imports, exports of coal, natural gas, crude oil, and refined petroleum products. GRA

N76-15615# Federal Energy Administration, Washington, D.C. Office of Energy Statistics.
ENERGY INFORMATION REPORTED TO CONGRESS AS REQUIRED BY PUBLIC LAW 93-319 Quarterly Report, Oct. - Dec. 1974
Mar. 1975 145 p refs
(PB-244606/0; FEA/C-75/239; QR-4) Avail: NTIS HC $6.00 CSCL 10A

This report is prepared on a regular basis in compliance with provisions of the Energy Supply and Environmental Coordination Act of 1974 (Public Law 93-319). Each issue contains summaries and statistical tables for the quarter on resource development and production, consumption, storage, distribution, imports, exports of coal, natural gas, crude oil, and refined petroleum products. GRA

N76-15616# TRW Systems Group, Redondo Beach, Calif.
EXPERIMENTAL GEOTHERMAL RESEARCH FACILITIES STUDY (PHASE O), VOLUME 1 Final Report
Robert H. Douglas, Carl E. Hilbers, and Russell O. Pearson 31 Dec. 1974 106 p refs 2 Vol.
(Grant NSF GI-44149)
(PB-243755/6; TRW-26405-6001-RU-00-Vol-1; NSF/RA/N-74-263A) Avail: NTIS HC $5.50 CSCL 10A

A representative liquid-dominated geothermal reservoir of moderate temperature and salinity is studied. Preliminary engineering design of an appropriate energy conversion system, identification of critical technology, and planning for implementation of experimental facilities are discussed. Results are summarized and recommendations and conclusions derived; implementation plans for the next two phases of the program are given. GRA

N76-15617# TRW Systems Group, Redondo Beach, Calif.
EXPERIMENTAL GEOTHERMAL RESEARCH FACILITIES

STUDY (PHASE O), VOLUME 2 Final Report
31 Dec. 1974 235 p refs 2 Vol.
(Grant NSF GI-44149)
(PB-243756/4; TRW-26405-6001-RU-00-Vol-2;
NSF/RA/N-74-263B) Avail: NTIS HC $8.00 CSCL 10A

The following topics are discussed: geothermal resources of the western United States; site selection process and the East Mesa geothermal field; East Mesa geothermal field reservoir characteristics; thermodynamic analyses; materials and corrosion factors; preliminary reliability/maintainability analyses; and environmental impact analysis guidelines. GRA

N76-15618# Dow Chemical Co., Midland, Mich.
ENERGY INDUSTRIAL CENTER STUDY Final Report, Jun. 1974 - Jun. 1975
Jun. 1975 472 p refs Prepared in cooperation with Environmental Res. Inst. of Mich., Ann Arbor, Townsend-Greenspan and Co., Inc., N. Y., and Cravath, Swain and Moore, N. Y.
(Grant NSF OEP-74-20242)
(PB-243823/2) Avail: NTIS HC $12.00 CSCL 10A

This report summarizes the findings of a study of the technical, environmental, economic, legal and regulatory aspects of two approaches to conserving fuel burned to produce steam; the generation of by-product electric power from the steam generated by industry for use in manufacturing, and the supplying of steam to industry from utility central power stations. Estimates were developed of the nationwide extent to which each approach is economically viable, and of the corresponding reductions in capital investment and fuel consumption. An assessment is made of the potential impacts on the electric utility industry and on electric rates over the next decade. Environmental issues to be faced in specific instances of implementation are identified for the pulp and paper, petroleum refining, and chemical industries. GRA

N76-15619# Dow Chemical Co., Midland, Mich.
ENERGY INDUSTRIAL CENTER STUDY: EXECUTIVE COMMITTEE SUMMARY REPORT AND POLICY PROPOSALS Final Report, Jun. 1974 - Jun. 1975
Paul W. McCracken, William G. Rosenberg, and Gerald L. Decker Jun. 1975 23 p refs Prepared in cooperation with Environmental Res. Inst. of Mich., Ann Arbor, Townsend-Greenspan and Co., Inc., N.Y., and Cravath, Swain and Moore, N.Y.
(Grant NSF OEP-74-20242)
(PB-243824/0) Avail: NTIS HC $3.50 CSCL 10A

The findings of a study on the technical, environmental, economic, legal, and regulatory aspects of two well-known approaches to conserving fuel burned to produce steam: (1) the generation of byproduct electric power from the steam generated by industry for use in manufacturing, and (2) the supplying of steam to industry from utility central power stations. GRA

N76-15620# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
ENERGY SUPPLY DEMAND/NEED AND THE GAPS BETWEEN. VOLUME 1: AN OVERVIEW Final Report
James W. Meyer, William J. Jones, and Myer M. Kessler 1 Dec. 1974 80 p refs
(Contract EPA-8-02-1308)
(PB-243976/8; MIT-EL-75-012-Vol-1) Avail: NTIS HC $5.00; HC also available in set of 2 reports as PB-243975-SET, PC $12.00 CSCL 10A

Based on a critical review of selected literature, energy supply, demand/need imbalances, and the operational/technological developments needed to redress these imbalances are examined. GRA

N76-15621# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
ENERGY SUPPLY, DEMAND/NEED AND THE GAPS BETWEEN. VOLUME 2: MONOGRAPH, WORKING PAPERS AND APPENDIX PAPERS Final Report
James W. Meyer, William J. Jones, and Myer M. Kessler 1 Dec. 1974 300 p refs
(Contract EPA-8-02-1308)
(PB-243977/6; MIT-EL-75-013-Vol-2) Avail: NTIS HC $9.25; HC also available in set of 2 reports as PB-243975-SET, PC $12.00 CSCL 10A

A number of working papers and monographs written in nonscientific language are presented for the general public describing the state-of-the-art and possibilities of several alternatives for helping in the near- and long-term energy crisis. GRA

N76-15622# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
MODIFICATIONS TO THE LOCKHEED-HUNTSVILLE SOLAR HEATING AND COOLING SYSTEMS SIMULATION PROGRAM Final Report, 7 Jun. 1974 - 7 Jun. 1975
Paul O. McCormick 7 Jul. 1975 41 p refs
(Contract NSF C-898)
(PB-244174/9; LMSC-HREC-TR-D390846;
NSF/RANN/SE/C-898/FR/75/2; NSF/RA/N-75-059) Avail: NTIS HC $4.00 CSCL 13A

This study was undertaken to make the solar heating and cooling systems simulation program more adaptable to general use. During this study the program was made more flexible for the user by input/output modifications and model improvement. A sample parametric study is provided to demonstrate the typical utilization of the program. A section is included which describes the limitations of the model as well as a section on actual use of the program (input/output). GRA

N76-15623# Houston Univ., Tex. Dept. of Mechanical Engineering.
THE EVALUATION OF SURFACE GEOMETRY MODIFICATION TO IMPROVE THE DIRECTIONAL SELECTIVITY OF SOLAR ENERGY COLLECTORS Annual Progress Report, 1 Jan. - 31 Dec. 1974
John R. Howell and Richard B. Bannerot 31 Jan. 1975 77 p refs
(Grant NSF GI-41003)
(PB-244376/0; UHME/Sol/5;
NSF/RANN/SE/GI-41003/PR-74-4; NSF/RA/N-75-074) Avail: NTIS HC $5.00 CSCL 13A

The performance of a flat plate solar energy collector can be greatly enhanced with the addition of spectrally (wavelength) and or directionally selective surfaces. Moderately concentrating collectors composed of parallel, east-west oriented, stationary, trapezoidal grooves are discussed. Computer simulations of radiative behavior with direct beam solar incidence are verified by model testing. GRA

N76-15624# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
THE ELIMINATION OR CONTROL OF MATERIAL PROBLEMS IN WATER HEAT PIPES Semiannual Progress Report, 1 Jan. - 30 Jun. 1975
G. F. Pittinato Jul. 1975 41 p refs
(Grant NSF GI-41310)
(PB-244427/1; MDC-G5481-D; NSF/RA/N-75-045) Avail: NTIS HC $4.00 CSCL 13A

The heat pipe life tests for the various candidate materials were conducted. The copper and nickel alloys showed a constant high level of performance while the ferrous alloys continued to undergo a slow performance recovery process. Diffusion calculations indicated that permeation of hydrogen gas through the heat pipe walls is a feasible mechanism for explaining the performance recovery process. Solid particles were found in the water contained by the Monel 400 and CDA 715 pipes. A scanning electron microscopy study of the oxide on the inside surfaces of the heat pipes revealed that the most tenacious and protective oxide formed on the 316 SS. GRA

N76-15625# Arizona State Univ., Tempe. Engineering Research Center.
TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION Annual Progress Report, 15 Jan. - 31 Dec. 1974
C. E. Backus 31 Jan. 1975 171 p refs
(Grant NSF GI-41894)
(PB-244590/6; ERC-R-75003;
NSF/RANN/SE/GI-41894/PR-74-4; NSF/RA/N-75-067) Avail: NTIS HC $6.75 CSCL 10B

Results of an investigation of the technical and economical potential of using concentration of sunlight onto photovoltaic

cells are given. Topic areas cover (1) solar cell and module design, (2) concentrator design, (3) optical filter design, (4) heat rejection, (5) solar tracking, and (6) system analysis. GRA

N76-15626# Oklahoma State Univ., Stillwater.
DEVELOPMENT OF AN ELECTRICAL GENERATOR AND ELECTROLYSIS CELL FOR A WIND ENERGY CONVERSION SYSTEM Final Report, 1 Jul. 1973 - 1 Jul. 1975
William L. Hughes, H. J. Allison, and R. G. Ramakumar 10 Jul. 1975 280 p refs
(Grant NSF GI-39457)
(PB-243909/9; NSF/RA/N-75-043) Avail: NTIS HC $9.25 CSCL 10B

Progress made on wind energy utilization research is reported. The specific objectives of this research program were: (1) to develop and build a working field modulated generator system in the 10/20 kW range suitable for use in a wind energy system to deliver standard 110/220 V single-phase 60 Hz power over a 2 to 1 range of speeds; (2) to develop and build a working high-pressure moderate-temperature electrolysis system in the 2-3kW input range in the available high pressure test facility; and (3) to design and construct a wind generator test station at the Stillwater airport using existing field modulated generators and bicycle-wheel type aeroturbines developed by the American Wind Turbine Company. GRA

N76-15627# Wisconsin Univ., Madison. Inst. for Environmental Studies.
ENERGY SYSTEMS FORECASTING, PLANNING AND PRICING
C. J. Cicchetti and W. K. Foell Feb. 1975 404 p refs Proc. of a French-Am. Conf., Madison, Wis., 28 Sep. - 3 Oct. 1974
(Grant NSF GI-43088)
(PB-243985/9; NSF/RA/N-75-042; LC-74-33226) Avail: NTIS HC $11.00 CSCL 10A

The French energy system is reviewed. Forecasting techniques, electricity planning and design, environmental impact analysis, electricity pricing (theory and practice), and price elasticity estimation are discussed. GRA

N76-15628# Cornell Univ., Ithaca, N.Y. Energy Project.
NATIONAL ENERGY NEEDS AND ENVIRONMENTAL QUALITY Final Report, 1 Aug. 1970 - 30 Apr. 1975
J. C. Thompson, Jr., W. R. Lynn, and J. G. Ebel 1975 100 p refs Sponsored by NSF
(PB-244411/5; NSF/RA/N-75-047) Avail: NTIS HC $5.00 CSCL 10A

Abstracts of reports generated by the Cornell Energy Project are presented. Topic areas covered include: technology assessment of energy; biological and environmental costs of energy; economics and energy perspectives; and legal and regulatory aspects of energy. GRA

N76-15629# Syracuse Univ., N.Y.
COMMERCIAL BUILDING UNITARY HEAT PUMP SYSTEM WITH SOLAR HEATING Semiannual Progress Report, 1 Jul. - 31 Dec. 1974
Eugene E. Drucker, John LaGraff, Howard Card, William Fleming, and Manas Ucar 1 Feb. 1975 79 p refs
(Grant NSF GI-43895)
(PB-244488/3; NSF/RANN/SE/GI-43895/PR-74-4; NSF/RA/N-75-075) Avail: NTIS HC $5.00 CSCL 13A

An algorithmic computational program has been written for determining the overall performance of a heating and cooling system for a school building. The system employs a series of water-to-air heat pumps connected in a closed loop, with a solar collector for heating and a large storage tank. The computer program includes an economic analysis of the solar assisted system on a 30 year life cycle basis. Preliminary computations were made on the school model for Washington, D.C., Boston, Mass., and Minneapolis, Minn., for an eight month heating season. GRA

N76-15630# Mitre Corp., McLean, Va.
IMPACT OF ENERGY DEVELOPMENTS ON THE SHEET METAL INDUSTRY
Arnold Cohen, Mary Harlow, and Augustus Johnson Jun. 1975 115 p
(PB-244274/7) Avail: NTIS HC $5.50 CSCL 13A

The present energy situation, the federal government's energy policies and programs, and the state-of-the-art in solar heating and cooling of buildings and in energy conservation are surveyed. A program of specific action for the Sheet Metal Workers International Association which will, at the same time, serve the nation's energy needs and provide employment opportunities for the Union's members is recommended. GRA

N76-15631# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
CHARACTERIZING COMBUSTIBLE PORTIONS OF URBAN REFUSE FOR POTENTIAL USE AS FUEL Report of Investigations
H. Schultz, P. M. Sullivan (Bur. of Mines, Coll. Park, Md.), and F. E. Walker Jul. 1975 32 p refs
(PB-244780/3; BM-RI-8044) Avail: NTIS HC $4.00 CSCL 13B

Urban refuse that was mechanically separated at the U.S. Bureau of Mines pilot plant in College Park, Md., was successfully evaluated for its fuel values using standard coal analysis methods. Analyses performed on refuse samples taken from five sample points included moisture, ash, sulfur, chlorine, and heating value. It was recommended that characterization of the combustible portion of urban refuse by standard coal analysis procedures should be widely adopted. GRA

N76-15632# Defense Electric Power Administration, Washington, D.C.
VULNERABILITY OF REGIONAL AND LOCAL ELECTRIC POWER SYSTEMS: NUCLEAR WEAPONS EFFECTS AND CIVIL DEFENSE ACTIONS Final Report
Brian K. Lambert (Texas Tech. Univ., Lubbock) and Joseph E. Minor (Texas Tech. Univ., Lubbock) Jul. 1975 85 p refs Sponsored in part by Defense Civil Preparedness Agency
(Contract DI-14-01-0001-1485)
(AD-A014431) Avail: NTIS CSCL 09/3

A systems evaluation technique developed for the Systems Evaluation Division Research of DCPA is used in evaluating a specific local electric power system within the Louisiana-Southern Mississippi region. The model used is highly flexible and can be used for electric power systems of any magnitude from a local level to a national level. The general model concept employs the use of generation and demand modes with transmission links, and includes an objective function which measures the response of a system to disruptions. Basically, the model is a constrained network flow model which is transformed into a modified transhipment linear programming format for analysis. GRA

N76-15633# National Bureau of Standards, Washington, D.C. Building Economic Evaluation.
SOLAR HEATING AND COOLING IN BUILDINGS, METHODS OF ECONOMIC EVALUATION
Rosalie T. Ruegg Jul. 1975 48 p refs
(COM-75-11070/0; NBSIR-75-712) Avail: NTIS HC $4.00 CSCL 13A

Economic issues important to the design and evaluation of solar heating and cooling systems in buildings are discussed. The use of life-cycle cost analysis and benefit-cost analysis to evaluate and compare the economic efficiency of solar and conventional energy systems is explained. The conditions for making cost-effective tradeoffs in solar system/building design are considered. By presenting the basic methods and assessing the appropriateness of alternative assumptions, the paper provides a resource document for researchers and analysts. GRA

N76-15634# Maryland Univ., College Park. Dept. of Mechanical Engineering.
PROCEEDINGS OF THE WORKSHOP ON SOLAR COLLECTORS FOR HEATING AND COOLING OF BUILDINGS
Stephen L. Sargent May 1975 500 p refs Workshop held at New York, 21-23 Nov. 1974
(Grant NSF AER-74-24639)
(PB-243908/1; NSF/RA/N-75-019) Avail: NTIS HC $12.50 CSCL 13A

This report presents summaries of technical presentations and panel discussions. Technical session topics were flat plate

liquid heating collectors; flat plate air heating collectors; focusing collectors; collector materials end components; numerical models; and testing and standards. Reports of working groups that met to consider each of these areas are included. GRA

N76-15635# Gordian Associates, Inc., New York.
INDUSTRIAL ENERGY CONSERVATION. THE CCMS PILOT STUDY. PROJECT AREA 1: AN INTERNATIONAL DATA BASE
25 Jun. 1974 74 p Sponsored by FEA
(PB-243923/0; FEA/D-74/142) Avail: NTIS HC $4.50 CSCL 10A

Information is presented on a data base already established for nine U. S. industries: aluminum, cement, copper, glass, paper, petroleum refining, plastic products, styrene butadiene rubber, and steel. GRA

N76-15636# Electric Power Research Inst., Palo Alto, Calif.
DIGEST OF CURRENT RESEARCH IN THE ELECTRIC UTILITY INDUSTRY
May 1975 123 p
(PB-243920/6; EPRI-RD-1) Avail: NTIS HC $5.50 CSCL 10A

A major objective of EPRI is to be a prime resource for information on scientific research and development activities in the field of electric energy. In response to this objective, EPRI has developed the Research and Development Information System (RDIS), which is a computerized data base of research projects sponsored by the institute and by individual electric utilities throughout the United States. RDIA provides the utility industry with a single, authoritative source of continuously updated information concerning in-progress, unpublished R and D projects. The program initiated information concerning in-progress, unpublished R and D projects. The program was initiated in 1974 and developed with the assistance of the EPRI Research Advisory Committee. This Digest is generated from the RDIS program. Contributors to this pilot volume were Consolidated Edison, EPRI, Pacific Gas and Electric, Philadelphia Electric, Southern California Edison, Tennessee Valley Authority, and Union Electric. The Digest will be issued annually. GRA

N76-15637# Northwestern Univ., Evanston, Ill. Dept. of Chemical Engineering.
REPORT OF CONFERENCE ON INNOVATIVE DESIGN TECHNIQUES FOR ENERGY EFFICIENT PROCESSES Final Report
Richard S. Mah 30 May 1975 95 p refs Conf. held at Evanston, Ill., 13-14 Mar. 1975
(Grant NSF ENG-75-08617)
(PB-243651/7; NU-CHE-75-001) Avail: NTIS HC $5.00 CSCL 10A

A number of pressing needs are identified of the process industries in meeting energy challenges. Increased NSF support is recommended in process-design related researches and graduate training in process design. Major areas of research are identified and specific recommendations are embodied. GRA

N76-15638# National Academy of Sciences - National Research Council, Washington, D.C. Numerical Data Advisory Board.
CONFERENCE ON THERMODYNAMICS AND NATIONAL ENERGY PROBLEMS
May 1975 441 p refs Conf. held at Warrenton, Va., 10-12 Jun. 1974
(Contracts AT(11-1)-2460; AT(49-18)-174; NSF C-310; Grant AF-AFOSR-2741)
(PB-243134/4; AMPS-65) Avail: NTIS HC $11.75 CSCL 10A

The report gives a summary, details, and particular needs in meeting national energy problems in the following areas: coal; fossil fuels other than coal; nuclear energy; geothermal energy; and solar energy and energy storage. GRA

N76-15639# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MICROMINIATURE SILICON HALL GENERATORS
M. M. Klenemtev, Yu. M. Orkodashvili, Ya. Sh. Palagashvili, O. K. Khomeriki, and A. N. Shaanov 31 Jul. 1975 13 p refs Transl. into ENGLISH from Akad. Nauk Gruz. SSR. Soobshcheniya (Tiflis), v. 67, no. 1, 1972 p 161-164
(AD-A014402; FTD-ID(RS)I-1778-75) Avail: NTIS CSCL 10/2

Specimens of microminiature Hall generators based on epitaxial silicon films on sapphire substrate have been developed and investigated. Some properties of these Hall generators are: active area approximately 60x60 square micrometers; thickness approximately 3 micrometers; input and output resistance approximately 400 to 500 ohms; specific sensitivity approximately 4.5 V/A.T; temperature coefficient of specific sensitivity does not exceed 0.1% degree. GRA

N76-15640# Texas Instruments, Inc., Dallas.
DEVELOPMENT OF LOW-COST THIN FILM POLYCRYSTAL LINE SILICON SOLAR CELLS FOR TERRESTRIAL APPLICATIONS Annual Progress Report, 1 Jan. - 31 Dec. 1974
Ting L. Chu Jun. 1975 83 p refs
(Grant NSF GI-38981)
(PB-244406/5; NSF/RANN/SE/GI-38981/PR-74-4; NSF/RA/N-75-073) Avail: NTIS HC $5.00 CSCL 10B

Polycrystalline silicon solar cell structures were deposited on borosilicate/steel, graphite, and metallurgical-grade silicon substrates by the thermal decomposition of silane and the thermal reduction of trichlorosilane containing appropriate dopants. Solar cells on borosilicate/steel substrates showed very low conversion efficiencies. Solar cells on graphite substrates of 6 sq cm area had AMO efficiencies of up to 2%, and a substantial improvement in efficiency is believed to be attainable by improving the chemical and structural properties of silicon. Solar cells on metallurgical silicon substrates with AMO efficiencies of up to 2.6% were obtained, and the optimization of the device structure will lead to further improvement of conversion efficiency. GRA

N76-15641# Resource Planning Associates, Inc., Cambridge, Mass.
ENERGY SUPPLY/DEMAND ALTERNATIVES FOR THE APPALACHIAN REGION Final Report
Mar. 1975 634 p refs
(PB-244621/9; RA-74-18; EQ-4AC022-V2) Avail: NTIS HC $16.25 CSCL 10A

An analytical methodology is developed for assessing various regional energy supply-demand projections and their related impacts. Fuel requirements, potential coal production, energy infrastructure requirements and the socioeconomic and environmental impacts of energy-related development in the Appalachian Region are discussed. The report scenarios are reviewed, each describing a set of national energy-environmental policies and their implications for future Appalachian development. GRA

N76-15642# Lehigh Univ., Bethlehem, Pa. Dept. of Geological Sciences.
ENERGY STORAGE USING LATENT HEAT OF PHASE CHANGE. 1: HYDRATES OF DISODIUM PHOSPHATE. 2: PROTOTYPE STORAGE RESERVOIR Final Report, 1 Jun. 1974 - 31 Jul. 1975
Dale R. Simpson 31 Jul. 1975 51 p refs
(Grant NSF P-416180-000)
(PB-244756/3; NSF/RANN/SE/P416180-00/FR-75-1; NSF/RA/N-75-064) Avail: NTIS HC $4.50 CSCL 10B

This report presents results of experiments and models for thermal energy storage using solution and precipitation of hydrates of disodium phosphate. The research was restricted to solutions having a sodium phosphate ratio from 2:1 to 1.4:1 and the temperature range of 10 to 60C. Solution density and pH was determined as a function of composition and temperature, and the large range in values makes the measurements useful as a monitoring technique. Solubility isotherms were experimentally established in order to establish the solution with the highest yield of material undergoing a phase change. Data on a previously unreported hydrate is presented. The latent heat for the phase change of the dodecahydrate is about 100 cal/cc. The heat capacity and thermal conductivity of selected solutions and crystals are reported. By using a non-stoichiometric solution and a process of precipitation and solution, in contrast to incongruent melting, the composition selected was cycled without degradation. The reservoir design is based on the concept of a vertical thermal stratification and the maintenance of seed crystals. GRA

N76-15643# Federal Energy Administration, Washington, D.C.
PROCEEDINGS OF THE CONFERENCE ON THE CHALLENGE OF LOAD MANAGEMENT. A CONVERGENCE OF DIVERSE INTERESTS Final Report
Aug. 1975 114 p refs Conf. held 11-12 Jun. 1975
(PB-244576/5; FEA/D-75/492) Avail: NTIS HC $5.50 CSCL 10A

Load management and electricity rate structures are presented. Load management potential, enabling technology, and impact on utilities, regulators, and consumers are discussed. Time-of-day pricing and solar potential in loaf management are also considered. FEA highlights the conservation potential in load management and rate reform and presents a program for achieving this potential. GRA

N76-15644# Battelle Columbus Labs., Ohio.
EVALUATION OF THE THEORETICAL POTENTIAL FOR ENERGY CONSERVATION IN SEVEN BASIC INDUSTRIES
E. H. Hall 11 Jul. 1975 444 p
(Contract DI-14-01-0001-1880)
(PB-244772/0; FEA/D-75/CE1) Avail: NTIS HC $11.75 CSCL 10A

The minimum theoretical energy requirements in seven basic industries is discussed. Through a thermodynamic analysis of the processes employed in each industry. The steel, copper, aluminum, glass, synthetic rubber, selected plastics and paper industries are included. Results of the calculations for these seven industries include the minimum theoretical energy, the efficiency of selected unit processes, and the effect of certain process changes on the energy use. A computer model was developed to perform the necessary calculations. The model performs the customary energy balances based on the first law of the thermodynamics. The results identify where large energy or availability losses occur. GRA

N76-15645# Rockwell International Corp., Canoga Park, Calif.
DEVELOPMENT OF LITHIUM-METAL SULFIDE BATTERIES FOR LOAD LEVELING Interim Report
J. Hall, S. Lai, L. McCoy, and R. Saunders Jun. 1975 47 p refs
(PB-244390/1; EPRI-116) Avail: NTIS HC $4.00 CSCL 10C

A lithium-iron sulfide battery was developed for electric utility energy storage which uses a molten KCl-LiCl electrolyte and is operated at about 400C. This report describes the work performed on iron sulfide positive electrodes and the status of associated elements of the project concerned with lithium negative electrodes, ceramic components, and cell design. Investigations of iron sulfide active materials, current conductive matrices, and electrode housings were made with the objective of developing low cost, long-lived iron sulfide electrodes. The iron sulfide electrodes were tested in cells using liquid lithium negative electrodes. Scaleup of iron sulfide electrodes from 5 sq cm to 25 sq cm in area was carried out successfully. A program for the preparation of high purity lithium-resistant ceramic components was initiated. GRA

N76-15646# Auburn Univ., Ala.
POTENTIAL FOR CONVERSION AND UTILIZATION OF SOLAR ENERGY IN POULTRY PRODUCTION Progress Report, 15 Sep. 1974 - 31 Jan. 1975
Robert N. Brewer and Jerry R. Dunn 28 Jan. 1975 33 p refs
(Grant NSF PTP-74-23987)
(PB-244375/2; NSF/RA/N-75-066) Avail: NTIS HC $4.00 CSCL 02E

Fuel use in the poultry industry is examined. Findings indicate primary fuel sources to be LP (liquid petroleum) gas, fuel oil, coal, natural gas and electricity. Solar systems evaluation, selection of sites for estimating solar requirements, and implementation of a model to simulate energy usage on a daily basis over the entire production period for a flock of birds are discussed. GRA

N76-15647# Mueller Associates, Inc., Baltimore, Md.
PRELIMINARY SAFETY ANALYSIS REPORT AND DESIGN REVIEW OF THE 2 KW(e) RADIOISOTOPE THERMOELECTRIC GENERATOR
Apr. 1975 221 p refs
(Contract N00025-74-C-0020)
(AD-A014591; MAI-127) Avail: NTIS CSCL 10/2

A Preliminary Safety Analysis Report (PSAR) and Design Review have been conducted for the 2 KW(e) Radioisotope Thermoelectric Generator (RTG). The objective of the PSAR was to appraise the risk to public health and safety resulting from the handling, transportation, emplacement, operation and recovery of the RTG system. The objective of the Design Review was to determine the state of development of the RTG system and its components and assess its ability to properly and reliably function in an undersea environment. GRA

N76-15648# GTE Labs., Inc., Waltham, Mass.
SEALED LITHIUM INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Mar. - 31 May 1975
N. Marincic and A. Lombardt Aug. 1975 27 p refs
(Contract DAAB07-74-C-0108; DA Proj. 1S7-62705-AH-94)
(AD-A014139; ECOM-74-0108-5; QR-5) Avail: NTIS CSCL 10/3

Electrolyte studies were continued using the standard size D cell as a test vehicle in an effort to establish the influence of various impurities on the passivation of lithium anodes. Impurities usually found in raw thionyl chloride, such as Cl2 and SO2, have been purposely added to the electrolyte to enhance any effect they might have on the lithium passivation. A rapid loss in the cell capacity in Cl2 containing electrolyte has been observed as a result of lithium corrosion. The cells showed the usual passivation in this electrolyte following the exhaustion of the chlorine in the corrosion reaction. An excess AlCl3 has been added to the electrolyte, knowing that it would attack the lithium surface and prevent the passivation for as long as there is an excess of AlCl3 in the electrolyte. The corrosion reaction proved to be too fast and the cell behavior appeared to be similar to that observed with an excess of Cl2. Iron impurities usually come to the electrolyte with AlCl3. A substantial increase in the cell voltage delay has been observed in the presence of iron added to the electrolyte in the form of FeCl3. GRA

N76-15649# Dow Chemical Co., Walnut Creek, Calif.
RESEARCH AND DEVELOPMENT IN THE GLASS FIBER SODIUM-SULFUR BATTERY Annual Report
Charles A. Levine 30 Jun. 1975 24 p refs
(Contract DAHC15-73-C-0254; ARPA Order 2381)
(AD-A014474) Avail: NTIS CSCL 10/3

The hollow fiber sodium-sulfur cell has been shown to have outstanding electrochemical characteristics. The major problem is to obtain increased lifetimes and still maintain the good performance. By observing the mode of failure of operating cells the authors have been able to separate those factors that cause shortened lifetime into several categories. They include: (1) glass fiber weakening at the tube sheet due to reaction with the tube sheet material; (2) mechanical configurations or damage that puts excess strain on parts of the cell; and, (3) degradation of the fiber itself as a function of its electrochemical environment. Small assemblies have been built in which degradation from the sodium side can be isolated from degradation occurring on the sulfide side of the cell. These assemblies allow the authors to run Na-Na cells in which they can change the quality of the sodium anolyte, the current density, and the number of column volumes of sodium charged or discharged per cycle. GRA

N76-15650# Army Foreign Science and Technology Center, Charlottesville, Va.
RESEARCH AND DEVELOPMENT PROJECT FOR NEW ENERGY TECHNOLOGY (SUNSHINE PLAN)
1974 787 p refs Transl. into ENGLISH from the monograph "Vita" Japan, 1974 410 p
(AD-A014534; FSTC-HT-23-0019-75) Avail: NTIS CSCL 10/1

In view of the world-wide energy crisis and environmental problems, it is recommended that Japan, as a country with no noteworthy natural resources, should immediately establish a national project in order to advance research and development programs of new energy technologies. The present status of technological development, in Japan and in other countries is reviewed. Solar energy, geothermal energy, synthetic natural gases and hydrogen energy are chosen as important subject matters of future research and development. If the presented time schedule is followed, a fairly large portion of the total demand for energy

will be supplied by these new energy sources by the year 2000. GRA

N76-15651# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
EVALUATION AND IMPROVEMENT OF A SEALED BATTERY SYSTEM FOR AIRCRAFT Final Technical Report, Nov. 1971 - Jul. 1974
Ted A. McWhorter Apr. 1975 62 p
(AF Proj. 3145)
(AD-A014337; AFAPL-TR-74-82) Avail: NTIS CSCL 10/3

A sealed nickel cadmium battery with an integral power conditioning package called a Maintenance Free Aircraft Battery was evaluated for compatibility and performance in B-52H, C-135, KC-135 and UH-1F aircraft. Modifications were made to the battery system, as necessary to achieve satisfactory performance. Flight test results are presented. General compatibility and good performance of the first version of the maintenance free battery system was experimentally demonstrated. It is recommended that further work be undertaken to establish a reliable, long term system. GRA

N76-15652# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
THE FEA PROJECT INDEPENDENCE REPORT: AN ANALYTICAL REVIEW AND EVALUATION Final Report
May 1975 99 p refs
(Contract NSF C-1030)
(PB-244741/5; MIT-EL-75-017) Avail: NTIS HC $5.00 CSCL 21D

Special attention is directed to presenting and evaluating the project independence evaluating system, the analytical system developed by FEA to support the study. Major problems in the oil and gas supply and the econometric demand model are identified and discussed, as are important international issues and linkages not adequately incorporated into the FEA analysis. GRA

N76-15653# Massachusetts Univ., Amherst.
TECHNICAL AND ECONOMIC FEASIBILITY OF THE OCEAN THERMAL DIFFERENCES PROCESS Quarterly Report, 30 Jun. - 30 Sep. 1974
C. R. Adams, L. L. Ambs, A. Chajes, W. P. Goss, and W. E. Heronemus 1 Dec. 1974 108 p refs
(Grant NSF GI-34979)
(PB-244447/9; NSF/RA/N-74-265; NSF/RANN/SE/GI-34979/PR-74-3) Avail: NTIS HC $5.50 CSCL 10B

Thermal cycle, machinery components, heat exchangers, hull structural mechanics, detail design, cold water inlet pipe structures, cold water and hot water hydraulics, resource hydrodynamics, statics and dynamics of naval architecture, and the biofouling problem and total system integration are covered. GRA

N76-15654# Battelle Columbus Labs., Ohio.
FUELS TECHNOLOGY: A STATE-OF-THE-ART REVIEW Final Environmental Protection Technology Series
E. H. Hall, D. B. Peterson, J. F. Foster, K. D. Kiang, and V. W. Ellzey Apr. 1975 264 p refs
(Contract EPA-68-02-1323)
(PB-242535/3; EPA-650/2-75-034) Avail: NTIS HC $9.00 CSCL 07A

A state-of-the-art review is given of various fuel cleaning, fuel conversion, and emission control technologies. Included are the following classes of technologies: physical and chemical coal cleaning, residual oil desulfurization, coal refining (liquefaction), coal and oil gasification, fluidized bed combustion of coal, and stack gas cleaning. For each technology, the report presents the extent of current practice and the status of systems under development. GRA

N76-15655# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONSEQUENCES OF EXTREME DAMAGE STATES FOR A BURST PROTECTED PRIMARY CIRCULATORY SYSTEM
21 Jul. 1975 38 p Transl. into ENGLISH from Inst. fuer Reaktorsicherheit der TUeV.E. V., Forschungsprojekt Berstsicherung (West Germany), 1975 p 1-11
(AD-A014409; FTD-ID(RS)I-1834-75) Avail: NTIS CSCL 18/9

Improved construction of burst protection for reactor pressure tanks was evaluated by considering conceivable failure possibilities. Results led to constructive changes on axial bracing, the support of the reactor tank, and on the attachment of the steam generators with burst protection. Author (GRA)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-15656 British Library Lending Div., Boston Spa (England).
ADVANCES IN THE CONTINUOUS DETECTION OF IMPORTANT CATIONS AND ANIONS IN THE TRACE RANGE
H. Ammer [1975] 29 p refs Transl. into ENGLISH from VGB Kraftwerkstechnik (West Ger.), v. 55, no. 2, Feb. 1975 p 109-119
(BLL-CE-Trans-6706-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The detection of trace ions in the effluent from mixed bed ion exchangers used for water deionization is considered. D.M.L.

N76-15657*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXTENSIVE 1-YEAR SURVEY OF TRACE ELEMENTS AND COMPOUNDS IN THE AIRBORNE SUSPENDED PARTICULATE MATTER IN CLEVELAND, OHIO
Robert B. King, J. Stuart Fordyce, Albert C. Antoine, Harold F. Leibecki, Harold E. Neustadter, and Steven M. Sidik Washington Jan. 1976 65 p refs
(NASA-TN-D-8110; E-8173) Avail: NTIS HC $4.50 CSCL 13B

Concentrations of 75 chemical constituents in the airborne particulate matter were measured in Cleveland, Ohio, during 1971 and 1972. Values covering a 1-year period (45 to 50 sampling days) at each of 16 sites are presented for 60 elements. A lesser number of values is given for sulfate, nitrate, fluoride, acidity, 10 polynuclear aromatic hydrocarbon compounds, and the aliphatic hydrocarbon compounds as a group. Methods used included instrumental neutron activation, emission spectroscopy, gas chromatography, combustion techniques, and colorimetry. Uncertainties in the concentrations associated with the sampling procedures, the analysis methods, the use of several analytical facilities, and samples with concentrations below the detection limits are evaluated in detail. The data is discussed in relation to other studies and source origins. The trace constituent concentrations as a function of wind direction are used to suggest a practical method for air pollution source identification. Author

N76-15658# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
SOME RESULTS OF AIRCRAFT MEASUREMENTS OF AEROSOLS IN THE MUNICH-INGOLSTADT AREA
Dieter Paffrath 12 Aug. 1975 27 p refs In GERMAN; ENGLISH summary
(DLR-FB-75-53) Avail: NTIS HC $4.00; DFVLR, Cologne DM 11.20

Aircraft sampling results and direct measurements of atmospheric aerosol concentrations and particle size distributions are presented and discussed. An impactor, which allows particle number measurement for particles above 0.5 micrometer and particle size analysis above 1 micrometer diameter, and a particle counter for direct measurement of particle concentration and size above 0.5 micrometer diameter, were used. Vertical concentration and size profiles show dependencies on atmospheric exchange parameters. Horizontal profiles may be used to investigate aerosol plumes of cities or industrial areas or even of single chimneys. Author (ESA)

N76-15659# Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control.
FIRST REPORT ON STATUS AND PROGRESS OF NOISE

RESEARCH AND CONTROL PROGRAMS IN THE FEDERAL GOVERNMENT. VOLUME 1: REPORT ON STATUS AND PROGRESS Final Report

Jun. 1975 254 p refs

(PB-243447/0; EPA-550/9-75-023-Vol-1) Avail: NTIS HC $9.00 CSCL 20A

Issued in compliance with Section 4(c)(3) of the Noise Control Act of 1972 (PL 92-574), this report describes Federal noise control and research activities and establishes a baseline of agency program information that may be used in subsequent years to assess progress in the Federal Government's noise control efforts. Thirty-nine Federal agencies were requested to submit information on their noise related activities to EPA. Volume 1 of the report contains a summary and assessment of reported activities which are described both by agency and by the following functional areas: noise standards and regulations, noise abatement, hearing conservation, technical assistance, and research. GRA

N76-15660# Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control.

FIRST REPORT ON STATUS AND PROGRESS OF NOISE RESEARCH AND CONTROL PROGRAMS IN THE FEDERAL GOVERNMENT. VOLUME 2: RESEARCH PANEL REPORTS Final Report

Jun. 1975 585 p refs

(PB-243448/8; EPA-550/9-75-023-Vol-2) Avail: NTIS HC $13.75 CSCL 20A

Issued in compliance with Section 4(c)(3) of the Noise Control Act of 1972 (PL 92-574), this report describes Federal noise control and research activities and establishes a baseline of agency program information that may be used in subsequent years to assess progress in the Federal Government's noise control efforts. Thirty-nine Federal agencies were requested to submit information on their noise related activities to EPA. Volume 2 consists of four reports describing Federal agency noise research, development, and demonstration programs in the areas of surface vehicle noise, aviation noise, noise effects, and machinery noise. The reports include project descriptions and fiscal data and were prepared jointly by the membership of four interagency research panels, formed in 1974 by EPA. GRA

N76-15661# Air Products and Chemicals, Inc., Marcus Hook, Pa. Houdry Div.

ENGINEERING AND COST STUDY OF AIR POLLUTION CONTROL FOR THE PETROCHEMICAL INDUSTRY. VOLUME 6: ETHYLENE OXIDE MANUFACTURE BY DIRECT OXIDATION OF ETHYLENE Final Report

D. E. Field, R. C. Barley, F. B. Higgins, Jr., J. A. Lee, and R. Newirth Jun. 1975 97 p refs

(Contract EPA-68-02-0255)

(PB-244116/0; EPA-450/3-73-006-F) Avail: NTIS HC $5.00 CSCL 07A

This volume covers the manufacture of ethylene oxide by direct oxidation of ethylene. Included is a process and industry description, an engineering description of available emission control systems, the cost of these systems, and the financial impact of emission control on the industry. Also presented are suggested air episode procedures and plant inspection procedures. GRA

N76-15662# Westinghouse Electric Corp., East Pittsburgh, Pa.

ECOLOGICAL INFLUENCE OF ELECTRIC FIELDS

J. W. Bankoske and Guy McKee (Penna. State Univ., Univ. Park) May 1975 27 p refs Sponsored by Elec. Power Res. Inst.

(PB-243873/7; EPRI-RP129) Avail: NTIS HC $4.00 CSCL 06F

The purpose of the project is to study the effects of electric fields on plants, animals, and soils in the vicinity of high voltage transmission lines. If biological effects are found which can be attributed to electric fields, the research project is designed to study the biological mechanism of these effects. The research team for this project coordinates the skills of engineers familiar with electric utility operations and instrumentation techniques with the work of biologists specializing in the practical aspects of plant and animal growth and behavior. Initial biological studies are being conducted at the Pennsylvania State University by experts in the fields of ethology, plant physiology, and ecology. After gaining sufficient experience in this new scientific area, a special purpose laboratory will be built at the Waltz Mill Underground Transmission Test Facility to provide the necessary facilities for continuing long range studies. Penn State will continue to provide biological support at the Waltz Mill Ecological Experimentation Station. GRA

N76-15663# National Marine Fisheries Service, Highlands, N.J. Coastal Fisheries Center.

AN ENVIRONMENTAL SURVEY OF EFFECTS OF DREDGING AND SPOIL DISPOSAL, NEW LONDON, CONNECTICUT Quarterly Report, Jul. - Sep. 1974

1 Nov. 1974 87 p Prepared in cooperation with Conn. Univ., Noank and New York Ocean Science Lab. Sponsored in part by the Navy

(AD-A014592; MACFC-Informal-40; QR-1) Avail: NTIS CSCL 13/2

The report considers the activities and findings of the several integrated research projects designed to monitor the environmental effects of dredging in the Thames River and dredge spoil disposal at the New London Dumping Ground. Surveys to establish baseline values for environmental conditions were completed by all parties prior to the 19 August onset of dredging. UCONN charted predredging temperature, salinity, suspended solids and light transmission characteristics in the lower Thames. New York ocean science laboratory conducted three predump surveys of the spoiling area to measure currents and movement of surface and bottom water masses and to determine baseline water column values for temperature, salinity, dissolved oxygen, pH, eH, total organic carbon, suspended and volatile solids. Middle Atlantic Coastal Fisheries Center has collected and is processing baseline and during dredging and spoiling samples from both river dump sites for characterization of sediment heavy metals (analysis by NYOSL), sediment types, micro-organisms and benthic macrofauna. GRA

N76-15664# National Marine Fisheries Service, Highlands, N.J. Coastal Fisheries Center.

AN ENVIRONMENTAL SURVEY OF EFFECTS OF DREDGING AND SPOIL DISPOSAL, NEW LONDON, CONNECTICUT Quarterly Report, Oct. - Dec. 1974

7 Feb. 1975 134 p refs Prepared in cooperation with Conn. Univ., Noank and New York Ocean Science Lab. Sponsored in part by the Navy

(AD-A014595; MACFC-Informal-49; QR-2) Avail: NTIS CSCL 13/2

The report considers the activities and findings of the several integrated research projects designed to monitor the environmental effects of dredging in the Thames River and dredge spoil disposal at the New London Dumping Ground. The report addresses field activities conducted and results obtained. UCONN completed three additional cruises in the Thames River to investigate suspended material transport. Progress has been made toward selecting a circulation model for determining dredging-induced variations, and toward characterizing average loads of suspended sediments during autumn. The UCONN report contains photographic documentation of the nature of spoils at the dump site and evidence of past dumping. SCUBA surveys conducted in late November and early December found no outstanding changes in bottom conditions. The NYOSL reports establish predisposal values for the physical and chemical oceanography of the dump site, and describe changes found in September and December as well as effects of single dumping events at those times. The report also presents predisposal concentrations of heavy metals in benthic animals. GRA

N76-15665# National Marine Fisheries Service, Highlands, N.J. Coastal Fisheriess Center.

AN ENVIRONMENTAL SURVEY OF EFFECTS OF DREDGING AND SPOIL DISPOSAL, NEW LONDON, CONNECTICUT Quarterly Report, Jan. - Mar. 1973

5 May 1975 138 p refs Prepared in cooperation with Conn. Univ., Noank and New York Ocean Science Lab. Sponsored in part by the Navy

(AD-A014596; MACFC-Informal-62; QR-3) Avail: NTIS CSCL 13/2

The report considers the activities and findings of the several integrated research projects designed to monitor the environmental effects of dredging in the Thames River and dredge spoil disposal

at the New London Dumping Ground. Field activities and findings to date are presented, with emphasis on studies conducted between 1 January and 31 March 1975. New York Ocean Science Laboratory occupied the dump site for physical and chemical measurements on 28 February and 6 March 1975. Current speeds, directions and durations for both dates are presented, along with returns to date from a drifter study. GRA

N76-15666# Battelle Columbus Labs., Ohio.
THE PHOTOCHEMICAL SMOG REACTIVITY OF DIESEL EXHAUST ORGANICS Final Report
Chester W. Spicer and Arthur Levy May 1975 89 p refs
(PB-244166/5; CRC-APRAC-CAPA-10-71-1) Avail: NTIS HC $5.00 CSCL 07E

A critical review of the state-of-the-art of the nature and photochemical smog reactivity of diesel engine exhaust organic components was conducted and possible future studies recommended. Pertinent literature was uncovered by both traditional and machine searching techniques. A major effort was devoted to obtaining unpublished result from researchers in the areas of diesel exhaust organic composition and reactivity of high molecular weight and partially oxidized hydrocarbons. GRA

N76-15667# Coast Guard, Washington, D.C.
TESTS OF COAST GUARD DEVELOPED HIGH SEAS OIL RECOVERY SYSTEMS AT EPA OHMSETT Final Report, Jul. - Sep. 1974
W. J. Chang Jun. 1975 129 p refs
(AD-A014495; USCG-D-101-75) Avail: NTIS CSCL 13/2

This report summarizes the full scale tank testing of Coast Guard developed High Seas Oil Recovery Systems which was conducted at the Environmental Protection Agency's Oil and Hazardous Materials Simulated Environmental Test Tank (EPA OHMSETT) in Leonardo, New Jersey. The tests were conducted during July through September of 1974. The objectives of the tests were: (1) to obtain quantitative and qualitative measures of performance for the Lockheed High Seas Oil Recovery System HSORS and the Ocean Systems Oil Recovery System 1000 (ORS 1000) and (2) to develop a standard test plan for the testing of oil skimmers. The tests were controlled and instrumented so as to give data on the oil recovery rate, oil recovery efficiency, and thruput efficiencies attained over a wide range of conditions. Descriptions of the test apparatus, the standard test plan employed, the instrumentation used, and the data reduction and analysis are included in the report. Author (GRA)

N76-15668# Shell Development Co., Houston, Tex. Pipeline Research and Development Lab.
A ZERO-RELATIVE-VELOCITY BELT SKIMMER Final Report
Ray R. Ayres, K. L. Bickham, J. P. Fraser, and P. E. Titus Apr. 1975 250 p refs
(Contract DOT-CG-42229-A)
(AD-A014497; USCG-D-116-75) Avail: NTIS CSCL 13/2

In the approach to high speed (4 to 10 knots) oil recovery discussed here, oil is collected from the water's surface due to a zero relative velocity (ZRV) between a moving belt and the oil layer. A loosely-tensioned sorbent belt floats like a blanket on the water imbibing oil for a 40-foot contact length before the belt is withdrawn and oil is squeezed out. The composite belt of Astroturf and Fuetron felt readily sorbs oils having viscosities ranging from light diesel oil to No. 6 fuel oil. Full scale simulations of the belt and wringer show maximum oil recovery rates between 1016 gpm and 2152 gpm for an eight-foot-wide belt at a speed of 6.8 knots. An 11 mm slick of Navy Special fuel oil (270 cs vicosity at 75 F) can be collected at 1296 gpm with only 10% additional water. At 10 knots we project oil recovery rates from 840 gpm for No. 6 fuel oil (2300 cs at 75F) to 2080 gpm and 1680 gpm for diesel oil (4.8 cs at 75F) and Navy Special oil respectively. The analytical and experimental feasibility studies indicate that further development of the hardware is warranted by the projected oil collection performance. Author (GRA)

N76-15669# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF AN OIL-WATER POLLUTION MONITORING SYSTEM Annual Progress Report, 1975
T. M. Houlihan and B. D. Tyler 30 Jul. 1975 90 p refs
(AD-A014552; NPS-59Hm75071A) Avail: NTIS CSCL 13/2

This report documents the progress during FY75 in the fabrication and the testing of an automatic oil pollution monitoring system. In the system developed, a Direct Difference method of Total Organic Carbon determination was utilized to ascertain oil concentrations. Using this monitor, it was possible to specify the concentration of any oil, independent of type, in an oil separator effluent sample. In the final phases of the study, preliminary investigations on prototype improvements were initiated and oil concentrations of bilge water samples were determined.
Author (GRA)

N76-15670# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
NATIONAL SUMMARY OF STATE IMPLEMENTATION PLAN REVIEWS (SECTION 4 ESECA), VOLUME 1: SYNOPSIS
Jul. 1975 26 p Prepared in cooperation with Argonne Natl. Lab., Ill. 2 Vol.
(PB-244418/0; EPA-450/3-75-053-a-Vol-1) Avail: NTIS HC $4.00 CSCL 13B

Each State Implementation Plan (SIP) is reviewed to determine if revisions can be made to control regulations for stationary fuel combustion sources without interfering with the attainment and maintenance of the National Ambient Air Quality Standards. It is intended to answer a number of anticipated questions arising from the review of the SIPs. GRA

N76-15671# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
NATIONAL SUMMARY OF STATE IMPLEMENTATION PLAN REVIEWS (SECTION 4 ESECA), VOLUME 2: TECHNICAL SUPPORT DOCUMENT Final Report
Jul. 1975 153 p refs Prepared in cooperation with Argonne Natl. Lab., Ill. 2 Vol.
(PB-244419/8; EPA-450/3-75-053-b-Vol-2) Avail: NTIS HC $6.75 CSCL 13B

A survey is given of the types of regulations, degrees of stringency, and methods used to apply controls to stationary fuel combustion sources, mainly sulfur dioxide. Wide variations are observed and reported. GRA

N76-15672# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
CONTROL OF PHOTOCHEMICAL OXIDANTS. TECHNICAL BASIS AND IMPLICATIONS OF RECENT FINDINGS
15 Jul. 1975 44 p refs
(PB-244428/9; EPA-450/2-75-005) Avail: NTIS HC $4.00 CSCL 13B

Laboratory and field studies are assessed which were conducted over the past several years, and the findings that affect current and projected programs to control oxidants are discussed. Both maximum concentrations and the frequency of violations of the air quality standards for oxidants decreased in some urban areas as a result of recently initiated controls. However, long thought to be primarily an urban problem, oxidant levels well in excess of the standard were observed in broad areas in the eastern third of the U.S. Although naturally occuring sources such as vegetation and the stratosphere do contribute to these high levels, man's activity is their predominant cause. Instances are noted in which oxidants and their precursor compounds have been carried up to 50 miles, and probably farther. More extensive control of oxidant-producing compounds will be required in rural areas while emphasis continues to be placed on control in the cities. GRA

N76-15673# Stanford Univ., Calif.
MERCURY IN THE BIOGEOCHEMICAL ENVIRONMENT Progress Report, 1 Oct. 1973 - 1 Oct. 1974
G. A. Parks, Perry L. McCarty, and J. O. Leckie Oct. 1974 43 p refs
(Grant NSF GI-40614)
(PB-244137/6; NSF/RA/E-74-020) Avail: NTIS HC $4.00 CSCL 13B

The dispersal and effects of mercury in the environment is examined. The stages of the investigation reported on include: (1) determination of the types of sources and sinks and the

location of probable important fluxes of mercury in areas chosen to include typical problem environments and (2) description and modelling of release, transport and fixation processes in typical environments. Opportunities for pollution control are identified and the design and feasibility analysis of pollution control methods are discussed. GRA

N76-15674# Exxon Research and Engineering Co., Linden, N.J. Analytical and Information Div.
MEASUREMENT OF VOLATILE AND NONVOLATILE HYDROCARBONS IN SELECTED AREAS OF THE ATLANTIC OCEAN Final Report, Jan. - Dec. 1974
R. A. Brown Jun. 1975 45 p
(Contract C-5-38000)
(COM-75-11112/0; AID.20BA.75.EE13TMR.75; MA-RD-920-75063) Avail: NTIS HC $4.00 CSCL 08J

Results are discussed of a subsequent study in selected areas of the Atlantic Ocean. Samples were analyzed as collected from a previously sampled area around Iceland and near the coast of Greenland. Data for surface and subsurface (-10 meter) water agree with previous measurements. A previously unsampled area off the northeast coast of South America was found to contain hydrocarbons and extractable organics at about the same level as the northern waters. Volatile (C4-C8) hydrocarbons were measured in some surface and surface samples from along the Gulf of Mexico/New York City tanker route. GRA

N76-15675# Syracuse Univ. Research Corp., N.Y. Life Sciences Div.
BENZENE, ENVIRONMENTAL SOURCES OF CONTAMINATION, AMBIENT LEVELS, AND FATE Final Report
P. H. Howard and P. R. Durkin Dec. 1974 73 p refs
(Contract EPA-68-01-2679)
(PB-244139/2; SURC-TR-74-591; EPA-560/5-75-005) Avail: NTIS HC $4.50 CSCL 13B

Available information pertinent to an assessment of benzene contamination of the environment is reviewed. Benzene losses from commercial (production and use) and noncommercial (automotive emissions and oil spills) sources were considered. It is estimated that of the total quantity that is released to the environment more than half results from motor vehicle emissions. Monitoring data somewhat support this contention. Available information on the environmental persistence of benzene suggests that it degrades slowly. GRA

N76-15676# Transportation Systems Center, Cambridge, Mass.
RAILROADS AND THE ENVIRONMENT, ESTIMATION OF FUEL CONSUMPTION IN RAIL TRANSPORTATION. VOLUME 1: ANALYTICAL MODEL Final Report, Nov. 1973 - Oct. 1974
John B. Hopkins May 1975 84 p
(PB-244150/9; DOT-TSC-FRA-75-16-1-Vol-1; FRA/ORD-75/74.1-Vol-1) Avail: NTIS HC $5.00 CSCL 13B

The report describes an analytical approach to estimation of fuel consumption in rail transportation, and provides sample computer calculations suggesting the sensitivity of fuel usage to various parameters. The model used is based upon careful delineation of the relevant physical machanisms of energy dissipation under steady-state conditions-rolling and aerodynamic resistance (using the Davis equations), braking, idling, and locomotive power generation and conversion losses. Both simple and more complex formulations are applied as appropriate. Several classes of service are considered: branch line freight, intercity freight, conventional and high-speed passenger, and commuter. Numerous graphs illustrate typical results for specific fuel consumption as a function of speed, grade, power/weight, load factor, weight per seat, etc. GRA

N76-15677# Battelle Columbus Labs., Ohio.
HAZE FORMATION, ITS NATURE AND ORIGIN Final Report
David F. Miller, Warren E. Schwartz, James L. Gemma, and Arthur Levy Mar. 1975 103 p refs Sponsored by EPA
(PB-244616/9; CRC-APRAC-CAPA-6-68-5) Avail: NTIS HC $5.50 CSCL 13B

This report documents the final year of a three year study of haze formation. The report is primarily concerned with the analysis of field data collected in previous years. Computer programs in time-series analysis were used to develop empirical models relating hourly light scattering averages to other air quality and meteorological data. The models, constructed from a continuous period of aerometric data in New York City, contain CO, NO2, relative humidity, and total hydrocarbons as predictor variables. The models have been successfully applied to quantitatively predict light scattering in other regions. GRA

N76-15678# Texas A&M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
MANAGEMENT OF TANK WASHINGS IN MARINE AND COASTAL COMMERCE
John Ball, Donald G. Adams, and Charles Alva Stryker Feb. 1975 85 p refs
(Grant NOAA-04-3-158-18)
(COM-75-11087/4; TAMU-SG-74-221; NOAA-75072201) Avail: NTIS HC $5.00 CSCL 13B

A one-year project was directed towards developing a management plan for treating and disposing of tank-cleaning wastes from barge-cleaning facilities. The study was limited to shipyards along the Texas Gulf Coast and was accomplished through a combined field survey program and laboratory effort. Wastewater characteristics and present treatment methods from the results of the field and laboratory effort are discussed. A proposed system is presented designed to adequately treat the wastewater and enhance the water quality of the Texas Gulf Coast. GRA

N76-15679# National Oceanic and Atmospheric Administration, Idaho Falls, Idaho. Air Resources Labs.
EFFLUENT DILUTIONS OVER MOUNTAINOUS TERRAIN
G. E. Start, N. R. Ricks, and C. R. Dickson Dec. 1974 169 p refs
(COM-75-11161/7; NOAA-TM-ERL-ARL-51; NOAA-75072502) Avail: NTIS HC $6.75 CSCL 13B

Atmospheric dilutions of air-borne effluents, conducted in the vicinity of mountainous terrain near Garfield, Utah, is described. The study was designed to quantify atmospheric dilution in rough mountainous terrain, without the strong channeling influences of the deep canyon. Aerial and ground-level sampling of the sulfur hexafluoride gaseous tracer were performed. Gas analyses were performed using an electron capture gas chromatograph. Meteorological observations included pibals, radiosondes, surface winds from a network of stations, and trajectories of radar-tracked tetroons. Sampled tracer concentrations during lapse conditions are compared with Pasquill's predicted values for flat terrain. Plume impaction was observed against the elevated terrain. GRA

N76-15680# Interplan Corp., Santa Barbara, Calif.
JOINT STRATEGIES FOR URBAN TRANSPORTATION, AIR QUALITY AND ENERGY CONSERVATION. JOINT ACTION PROGRAMS
Roman Krzyczkowski, Suzanne S. Henneman, Charles L. Hudson, Evelyn S. Putnam, and Donna J. Thiesen Dec. 1974 378 p refs
(Contract N00140-74-C-6026)
(PB-244473/5; UMTA-RI-06-0005-75-1; Rept-7346-R) Avail: NTIS HC $10.75 CSCL 13B

An integrated approach is developed for resolving problems created by traffic congestion, air pollution, and petroleum shortages. The basic relationships among the strategies and actions are summarized in a matrix display. Each item is ranked to access its impact on six subgoals, or phenomena, in the near or long term: improved auto alternative; improved vehicular flow; reduced auto use; reduced travel demand; reduced vehicular emissions; and reduced vehicular petroleum consumption. Two synergistic joint action programs are presented. An information review of experience, impacts on goals (mobility, air quality, energy conservation), and an overall evaluation of 54 specific actions are included. GRA

N76-15681# Research Triangle Inst., Research Triangle Park, N.C. Center for Technology Operation.
PROCEEDINGS OF CONFERENCE ON ENVIRONMENTAL ASPECTS OF CHEMICAL USE IN RUBBER PROCESSING OPERATIONS
Jul. 1975 442 p refs Conf. held at Akron, Ohio, 12-14 Mar. 1975

(Contract EPA-68-01-2928)
(PB-244172/3; EPA-560/1-75-002) Avail: NTIS HC $11.75 CSCL 13B

The environmental impact of chemicals in various industrial operations was examined. The objective was to cover and discuss current chemical use, functions of chemicals in the operations, byproducts likely to be introduced, known health or environmental effects from chemicals used, and measures used or available for use to control environmental contamination. More specifically, papers were presented and discussions held that covered industrial emissions and effluent surveys, chemicals and their effects, reclamation and disposal and academic programs. GRA

N76-15682# Versar, Inc., Springfield, Va.
ASSESSMENT OF INDUSTRIAL HAZARDOUS WASTE PRACTICES, INORGANIC CHEMICALS INDUSTRY Final Report, Jun. - Dec. 1974
R. G. Shaver, L. C. Parker, E. F. Rissman, K. M. Slimak, and R. C. Smith Mar. 1975 502 p refs
(Contract EPA-68-01-2246)
(PB-244832/2; EPA-530/SW-104C) Avail: NTIS HC $12.75 CSCL 13B

Inorganic chemical manufacturing operations are examined in terms of land-destined wastes. Approximately 40 million metric tons (dry basis) of land-destined wastes were generated by this industry in 1974, of which 2 million metric tons were considered to be potentially hazardous. The most prevalent method of disposal of potentially hazardous wastes from this industry is some form of land disposal, with about 85 percent of the wastes deposited in landfills, lagoons, and dumps. GRA

N76-15683# Versar, Inc., Springfield, Va.
TECHNICAL AND MICROECONOMIC ANALYSIS OF CADMIUM AND ITS COMPOUNDS Final Report
Donald H. Sargent and John R. Metz Mar. 1975 213 p refs
(Contract DI-68-01-2926)
(PB-244625/0; EPA-560/3-75-005) Avail: NTIS HC $7.75 CSCL 13B

The role of cadmium and its compounds in the environment and in the economy of the United States was studied, to evaluate the need for and the projected effect of controlling its production, use and dissipation. Technologically and economically feasible control alternatives were developed. The results led to two sets of recommended controls. The first, aimed at preventing increases in the present cadmium health hazards, consists of continued air and water pollution abatement, environmentally-sound land disposal of industrial wastes and residuals, and regulation of application rates to agricultural lands of cadmium-bearing materials. The second set of controls exhibits a more aggressive posture towards limiting cadmium dissipation. GRA

N76-15684# Office of Technology Assessment, Washington, D.C.
OIL TRANSPORTATION BY TANKERS: AN ANALYSIS OF MARINE POLLUTION AND SAFETY MEASURES
Jul. 1975 305 p
(PB-244457/8) Avail: NTIS HC $9.75 CSCL 13B

A factual background on tankers, a discussion of issues related to the safety of tanker operation, and the potential presented by tankers for introducing polluting oil into the marine environment are discussed. Technical alternatives concerning the design, construction and operation of tankers in U.S. waters as these relate to safety and pollution prevention are presented. Supertanker operations are given emphasis when they present particular or unusual problems. GRA

N76-15685# Baker (Michael, Jr.), Inc., Beaver, Pa.
INVESTIGATION OF MINING RELATED POLLUTION REDUCTION ACTIVITIES AND ECONOMIC INCENTIVES IN THE MONONGAHELA RIVER BASIN Final Report
F. J. Doyle, C. Y. Chen, R. D. Malone, and J. R. Rapp Apr. 1975 380 p refs
(Contract ARC-72-89/RPC-707)
(PB-244352/1; BAKER-ARK-75-10) Avail: NTIS HC $10.75 CSCL 13B

Information is given on feasible economic incentives which will encourage the private sector and others to undertake environmental improvement activities on abandoned and active mines in the Monongahela River Basin. The undertaking of these activities with the recovery of restoration expenses at a profit will help lessen the crushing pollution abatement cost to government in the basin. Major subjects discussed are: controlling surface water infiltration in underground mines, coal waste utilization, engineering properties of coal waste, land reclamation and recovery of coal reserves from partially worked out mines. GRA

N76-15686# Massachusetts Univ., Amherst. Water Resources Research Center.
ENVIRONMENTAL IMPACT EVALUATION IN FRESHWATER IMPOUNDMENTS BY VEGETATION ANALYSIS OF THE TERRESTRIAL ECOSYSTEM
Patrick W. Fairbairn and Carl A. Carlozzi Apr. 1975 156 p refs
(PB-244505/4; Completion-FY-75-4; Pub-49; W75-10905; OWRT-A-053-MASS(1)) Avail: NTIS HC $6.75 CSCL 13B

The objective was to develop and test a method of analyzing the ecological impact of artificially impounded floodwaters on the terrestrial environment. The approach was to apply techniques of field ecology to three similar river systems each subject to a different management regimen, with a view to determining levels of relative community stability in terms of successional maturity. Degree of environmental impact was described in terms of vegetative characteristics correlated with elevation, including life form, species dominance, diversity indices, biomass, seasonal distribution of flowering, method of seed dispersal, and number of exotics and annuals present. Emphasis was on community rather than single-species attributes. By this means it was possible to show the cumulative impact of flooding across a vertical range of 60 feet. GRA

N76-15687# Ford Motor Co., Dearborn, Mich. Research Staff.
THE RELATIONSHIP OF VEHICLE EMISSION STANDARDS AND AIR QUALITY STANDARDS, VOLUME 1 Final Report
Tai Yup Chang, Serge Gratch, and Bernard Weinstock 10 Jul. 1975 149 p refs
(PB-244823/1; RS-75/1) Avail: NTIS HC $6.00 CSCL 13B

The national ambient air quality standards (AQS) for nonmethane hydrocarbons, carbon monoxide, oxides of nitrogen, and oxidant and the relevant data are reviewed critically. The relationships between the vehicle emission standards (VES) and the corresponding AQS are discussed in terms of available and improved models. It is concluded that, for a two-car strategy, VES within the ranges listed with a few localized exceptions will achieve by 1985 the AQS for NO2, CO and oxidants. If a single set of VES were to be used for all 50 states, then the ranges shown above for California would apply. These results are compared with those obtained in a similar study by the National Academy of Science/National Academy of Engineering. GRA

N76-15688# Environmental Research and Technology, Inc., Santa Barbara, Calif.
LOS ANGELES REACTIVE POLLUTANT PROGRAM (LARPP) DATA ARCHIVING AND RETRIEVAL Final Report, Feb. - Jun. 1975
R. O. Parker (Gen. Res. Corp., Santa Barbara, Calif.) and J. R. Martinez Jul. 1975 137 p
(PB-244295/2; ERT-P-1464-W) Avail: NTIS HC $6.00 CSCL 13B

This report describes the archive for the Los Angeles reactive pollutant program and a computer program designed for retrieving the data in the archive. The data are stored on magnetic tapes and the contents of the tapes are described in detail. Examples of the use of the retrieval program are given. GRA

N76-15689# Environmental Dynamics, Inc., Los Angeles, Calif.
DEVELOPMENT OF AN ECONOMIC ANALYTICAL FRAMEWORK FOR SOLID WASTE POLICY ANALYSIS
Jeffrey Hall and Stephen E. Jacobsen Sep. 1975 135 p refs
(Contract EPA-68-03-0212)
(PB-244705/0; EPA-600/5-75-014) Avail: NTIS HC $6.00 CSCL 13B

A micro-economics/systems overview of the problems of solid waste generation and control is presented. A benefit measure which incorporates the consumers' surplus approximation to welfare loss, changes in firms' profits and government revenues, and costs of solid waste disposal is used to develop a series of taxation (taxes may be negative) models for the purpose of control of the solid waste stream. Economic incentives for encouraging forth supplies of recyclable materials are examined. It is concluded that the collateral policies of solid waste taxation and the subsidization of supplies of recyclable materials provide highly workable management tools for the purposes of solid waste control and recycling encouragement. GRA

N76-15690# California State Dept. of Health, Berkeley. Air and Industrial Hygiene Lab.
ASBESTOS FIBER ATLAS Final Environmental Projection Technology Series
Peter K. Mueller, Arthur E. Alcocer, Ronald L. Stanley, and Glenn R. Smith Apr. 1975 58 p refs
(Grant EPA-801336)
(PB-244766/2; CA/DOH/AIHL-98; EPA-650/2-75-036) Avail: NTIS HC $4.50 CSCL 13B

Transmission electron micrographs and corresponding selected area electron diffraction patterns of standard specimens of serpentine and amphibole asbestos are presented for use by analysts as an aid in identification. Micrographs and diffraction patterns of typical ambient air samples and of certain minerals that often occur with airborne asbestos are also included. Specimens were uniformly prepared and examined in a single electron microscope. GRA

N76-15691# Little (Arthur D.), Inc., Cambridge, Mass.
ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES ORGANIC CHEMICALS INDUSTRY (MAJOR PRODUCTS) Final Report
Aug. 1975 114 p refs
(Contract EPA-68-01-1541)
(PB-244816/5; ADL-C-75938-05; EPA-230/2-75-019) Avail: NTIS HC $5.50 CSCL 07A

An initial analysis of the economic impact of proposed water effluent guidelines upon the organic chemicals industry was performed based on abatement cost data supplied by the EPA. In view of limited cost data available, the impact was based on best practicable control technology currently available. On this basis, with 75% coverage of the industry, the following specific chemicals appear to face significant water pollution control problems: ethylene glycol, caprolactam, methanol, acetic acid, acetone, phenol, aniline, coal tar products, ethyl cellulose, dyes and pigments, and unformulated pesticides. GRA

N76-15692# National Environmental Research Center, Las Vegas, Nev. Monitoring Applications Lab.
NONPOINT-SOURCE POLLUTIONS IN SURFACE WATERS, ASSOCIATED PROBLEMS AND INVESTIGATIVE TECHNIQUES Final Report
Jun. 1975 47 p refs
(PB-243995/8; EPA-680/4-75-004) Avail: NTIS HC $4.00 CSCL 13B

The following topics are discussed: nature and origin of nonpoint-source pollution; sources of nonpoint pollutants; prediction of nonpoint-source pollution; and nonpointsource monitoring. GRA

N76-15693# Commerce Dept., Washington, D.C.
THE EFFECTS OF POLLUTION ABATEMENT ON INTERNATIONAL TRADE, 3
Apr. 1975 523 p refs
(COM-75-11159/1) Avail: NTIS HC $11.00 CSCL 13B

The third report of the secretary of commerce to the president and congress act amendments of 1972 (Public Law 92-500) is presented. Portions of this document are not fully legible. GRA

N76-15694# Battelle Columbus Labs., Ohio.
SCREENING STUDY TO DEVELOPMENT BACKGROUND INFORMATION AND DETERMINE THE SIGNIFICANCE OF AIR CONTAMINANT EMISSIONS FROM PESTICIDE PLANTS
C. N. Ifeadi Mar. 1975 85 p refs
(Contract EPA-68-02-0611)
(PB-244734/0; EPA-540/9-75-026) Avail: NTIS HC $5.00 CSCL 07A

Background information is gathered from published data and responses to the questionnaires sent to the pesticide manufacturing firms. Manufacturing processes, raw and waste material handling, air contaminant emission sources, quantity or quality, and pollutants, together with their present practical control methods are discussed. Significance of air contaminant emissions from the pesticide industries is evaluated on the basis of available data on the emission quantities and/or toxicity emitted. GRA

N76-15695# National Ecological Research Lab., Corvallis, Oreg.
CHEMICAL/BIOLOGICAL RELATIONSHIPS RELEVANT TO ECOLOGICAL EFFECTS OF ACID RAINFALL Final Report
John O. Reuss Jun. 1975 53 p refs
(PB-244409/9; EPA-660/3-75-032) Avail: NTIS HC $4.50 CSCL 08M

Problems of measurement and interpretation of rainfall acidity are considered in terms of effects on the soil-plant system. The theory of the carbon dioxide-bicarbonate equilibria and its effect on rainfall acidity is given. The relationship of a cation-anion balance model of acidity in rainfall to plant nutrient uptake processes is discussed. GRA

N76-15696# Soil Conservation Service, Washington, D.C.
AGRICULTURAL WASTE MANAGEMENT FIELD MANUAL Final Report
Aug. 1975 352 p refs
(PB-244466/9; SCS/ENG-FM-AWM) Avail: NTIS HC $10.50 CSCL 02C

The manual is intended primarily for use in planning and installing agricultural waste management systems. Major emphasis is on management of wastes from concentrated livestock operations although recycling or disposal of solid and liquid community wastes on agricultural land is also discussed. Characteristics of various wastes are covered as well as their effects on soils, plants, water, fish, and wildlife. Topics discussed include: planning complete livestock and poultry waste management systems; design of system components including waste storage facilities, lagoons, settling facilities, holding ponds, waste irrigation systems and other conservation practices; guidance in management of pesticides and other chemicals and in monitoring and sampling of water quality. GRA

N76-15697# Army Construction Engineering Research Lab., Champaign, Ill.
ENVIRONMENTAL PROTECTION GUIDELINES FOR CONSTRUCTION CONTRACT SPECIFICATION WRITERS Final Report
R. E. Riggins, R. J. Fileccia, D. C. Hittle, E. W. Novak, P. D. Schomer, and L. V. Urban Jul. 1975 125 p refs
(DA Proj. 4A1-62121-A-896)
(AD-A014146; CERL-IR-E-72) Avail: NTIS CSCL 13/13

This report emphasizes the need for environmental provisions in construction contracts and develops related guidelines for construction contract specification writers. Factors which determine the types of environmental provisions needed in construction contracts are examined, and a format for the environmental section of construction contracts is developed. Environmental provisions are described and examples are given, with special emphasis upon landscape protection, air quality, water quality, and noise. GRA

N76-15698# Alaska Univ., College. Inst. of Marine Science.
ARCTIC OIL BIODEGRADATION Final Report
D. K. Button Dec. 1974 45 p refs
(Contract DOT-DG-24722-A)
(AD-A014096; USCG-D-114-75) Avail: NTIS CSCL 06/13

The abundance of microbial hydrocarbon oxidizers is reported from measurements in three widely distributed marine systems in the far north. Concomitant in situ organic substrate oxidation rates measured by (14)CO2 collection were 0.2 to 1.6 ng/l hr from an initial added concentration of 1.4 micrograms/l mixed amino acids and 2 to 50 ng/l hr from added dodecane solution. The solubility of dodecane in saline medium was determined and the predictability of high molecular weight alkane solubility confirmed. This true solution was used to show that a relatively

high molecular weight hydrocarbon can be co-metabolized along with another substrate (arginine) from the dissolved phase. Dodecane derived CO2, arginine and glutamic acid were recovered from the 14C-dodecane, 12C-arginine medium after having been supplied to a continuous culture of a marine hydrocarbon oxidizing isolate. Clay sorption experiments were conducted which showed that the catalytic role of suspended sediments was negligible. No dodecane sorption by bentonite could be detected in a 20% saturated hydrocarbon solution. These and other data presented support the assumption that direct dissolved phase organic material metabolism is a normal ubiquitous marine process having characteristics compatible with submicrogram per liter steady state hydrocarbon concentrations. GRA

N76-15699# Naval Research Lab., Washington, D.C.
LOW COST COMPACT X-RAY FLUORESCENCE ANALYZER FOR ON-SITE MEASUREMENTS OF SINGLE ELEMENTS IN SOURCE EMISSIONS Final Report
L. S. Birks and J. V. Gilfrich 26 Aug. 1975 16 p refs
(AD-A014582; NRL-7926) Avail: NTIS CSCL 14/2

A low cost, compact wavelength dispersion X-ray fluorescence analyzer has been designed using mostly state-of-the-art commercial components. A prototype instrument has been built for less than $5000 and tested in the field. With X-ray tube power of 80 watts (40 kV, 2 mA) the 100 second 3 sigma detection limits range from 0.1 to 1 microgram/sq cm for atomic numbers 23 (V) to 48 (Cd) using K alpha lines and from atomic numbers 74 (W) to 92 (U) L alpha lines. GRA

N76-15700# Southwest Research Inst., San Antonio, Tex.
COLLABORATIVE STUDY OF REFERENCE METHOD FOR MEASUREMENT OF PHOTOCHEMICAL OXIDANTS IN THE ATMOSPHERE (OZONE-ETHYLENE CHEMILUMINESCENT METHOD) Test Report, Mar. 1970 - Sep. 1975
Herbert C. McKee, Ralph E. Childers, and Van B. Parr Feb. 1975 49 p refs
(Contract AP-70-40)
(PB-244105/3; SwRI-01-2811(1975); EPA-650/4-75-016) Avail: NTIS HC $4.00 CSCL 13B

In the first phase test, ten collaborators were assembled at a common site to measure (from a common source) ambient and ozone supplemented concentrations over a range from 0 to .510 ppm (0-1000ug/m). The data were analyzed to derive an estimate for the precision of the method. Estimates of the standard deviations of the process for total, between-laboratory, and within-laboratory were derived, as well as for the lower detectable limit. The second phase consisted of a collaborative test involving eleven laboratories to determine the accuracy (bias) of the method. Ozone generating systems (synthetic atmosphere) were supplied to each collaborator. Five concentration levels (known to the test designer) were measured at each laboratory. GRA

N76-15701# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REMOVAL OF RADIOACTIVE AEROSOLS AND GASES FROM EXHAUST AIR
W. Ullman, F. Schumann, and R. Schwarzbach 7 Aug. 1975 23 p refs Transl. into ENGLISH from Staatl. Zentrale fuer Strahlenschutz (Berlin), report SZS-142, 1972 p 1-14
(AD-A014405; FTD-ID; SZS-142) Avail: NTIS CSCL 18/8

The National Center for Radiation Protection of the GDR (East Germany) is the national scientific center and control organ for all radiation problems coming from the peaceful use of nuclear energy, as well as questions of safety, and is thus responsible for completion and protection, radiation therapy, nuclear environmental protection, nuclear-plant safety including research in the medical-biological and scientific-technological area necessary for it. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N76-15702 Polish Academy of Sciences, Warsaw.
METHODS FOR DETERMINING STRESSES AND DEFORMATIONS IN GEOLOGICAL FORMATIONS [METODY WYZNACZANIA NAPREZEN I ODKSZTALCEN W GOROTWORZE SAP AVAIL: ISSUING ACTIVITY]
Andrzej Dragon 5 Jul. 1975 32 p refs In POLISH

A method for analyzing geological formations is presented in support of a dilitation plasticity model. Classical analysis methods are included and discussed. Transl. by M.J.S.

N76-15703 Johns Hopkins Univ., Baltimore, Md.
FAR ULTRAVIOLET ATOMIC AND MOLECULAR NITROGEN EMISSIONS IN THE DAY AIRGLOW Ph.D. Thesis
Peter Zoltan Takacs 1975 143 p
Avail: Univ. Microfilms Order No. 76-1503

The far ultraviolet day airglow between 1130 A and 1520 A was observed at 4.4 A spectral resolution with a scanning spectrophotometer aboard an Aerobee rocket on 11 December 1972 at 14:38 MST from White Sands, New Mexico. The solar zenith angle was 67 deg. A low scattered light level (.02% of the Ly alpha and OI 1304 A intensities) and a negligible dark count rate permitted detection of signals as weak as 5 Rayleighs. Fourteen bands or blends of the N sub 2 Lyman-Birge-Hopfield system were clearly resolved and their relative intensities were found to be in good agreement with laboratory and theoretical electron impact excitation spectra. No bands from v' greater than 6 were observed, indicating at least 50% predissociation in these levels. Extrapolation of the observed LBH intensity to a solar zenith angle of 0 deg gives a total LBH column emission rate of 3.0 + or - 0.4 kR. The photoelectron flux altitude dependence is derived by fitting a model electron flux altitude profile to reproduce the observed LBH column emission rate, using the well-known LBH electron impact excitation cross section. Dissert. Abstr.

N76-15704 California Univ., San Diego.
SOURCE MECHANISMS OF AFTERSHOCKS OF THE 1971 SAN FERNANDO, CALIFORNIA EARTHQUAKE Ph.D. Thesis
Brian Edwin Tucker 1975 245 p
Avail: Univ. Microfilms Order No. 75-29466

Aftershocks of the February 9, 1971 San Fernando, California earthquake were studied. The spectra of all the small and about half of the large events have a single corner frequency, (always between 3 and 30 Hz), above which the spectra are proportional and below which they are constant. The spectra of the other large events each have two corner frequencies: one between .1 and .5 Hz, below which the spectra are constant, and one between 3 and 10 Hz above which the spectra are proportional. These observations suggest differences (other than scale) in source mechanism and are interpreted in the following way: all the small events and about half of the large events are produced by rock failures that are limited in time and space. The other large events are caused by the initial rupture growing in time to 2 seconds and/or in space to 6 km. Source mechanism and perhaps regional stress determine the general shape of the spectra while interference along the propagation path determines their detailed character. Dissert. Abstr.

N76-15705*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
ANALYSIS OF DATA FROM THE LOCKHEED EXPERIMENT ON ATS-5 Final Report
Richard D. Sharp 2 Sep. 1975 101 p refs
(Contract NASw-2656)
(NASA-CR-145986; LMSC/D460734) Avail: NTIS HC $5.50 CSCL 04A

Satellite observations of auroral electrojets, electron fluxes, and magnetic storm activity are presented and discussed. Plasma-particle interactions are examined for the earth's magnetosphere, and data (i.e., magnetograms) of the satellite observations are analyzed. For individual titles, see N76-15706 through N76-15708.

N76-15706* Lockheed Missiles and Space Co., Palo Alto, Calif.
A RELATIONSHIP BETWEEN SYNCHRONOUS-ALTITUDE ELECTRON FLUXES AND THE AURORAL ELECTROJET,

APPENDIX A
R. D. Sharp, E. G. Shelley, and G. Rostoker (Alberta Univ.) *In its* Analysis of Data from the Lockheed Experiment on ATS-5 2 Sep. 1975 24 p refs Revised Submitted for publication (For availability see N76-15705 06-46)
CSCL 04A

Simultaneous observations during four substorms are reported from the Lockheed auroral particle spectrometer on ATS-5 and the University of Alberta meridian magnetometer chain (Canada). During the four events studied, there was a good correlation between the magnitude of the trapped electron fluxes in the energy range from 1.8 to 53 keV and the magnitude of the electrojet current as measured by a station in the magnetometer chain at a latitude close to that expected for the ATS conjugate point. The Hall effect was studied and a model electrojet was constructed which gave a good absolute agreement between the two measured quantities. The results are consistent with the convection electric field remaining approximately constant during a substantial portion of each of the substorms studied. The temporal variations of the electrojet were apparently controlled by conductivity changes in the ionosphere as determined by the precipitating auroral electrons. Author

N76-15707* Lockheed Missiles and Space Co., Palo Alto, Calif.
COORDINATED ATS-5 ELECTRON FLUX AND SIMULTANEOUS AURORAL OBSERVATIONS, APPENDIX B
S. B. Mende and E. G. Shelley *In its* Analysis of Data from the Lockheed Experiment on ATS-5 2 Sep. 1975 44 p refs (For availability see N76-15705 06-46)
CSCL 04A

All Sky Cameras (ASCA) magnetosphere observations were made at the field line conjugate of the ATS-5 Satellite. The magnetosphere region examined was L=5 to L=11. The correlation of the auroras observed by the ASCA's and the magnetospheric trapped fluxes was studied. It is shown that auroral forms are not simply correlated with the synchronous altitude electron fluxes. The presence of hot plasma at the ATS-5 satellite is a necessary but not sufficient condition for the occurrence of local auroras. On quiet days the hot plasma does not penetrate into the magnetosphere far enough to reach the ATS-5 orbit. Under these conditions no auroras are observed at the field line conjugate, but auroras are usually observed on higher latitude field lines. On more disturbed days, auroral arcs are observed at lower latitudes when the plasma sheet penetrates into the ATS-5 orbit. Significant qualitative correlation between the ASCA data and the trapped fluxes was observed when a local plasma injection event occurred near ATS-5. Magnetograms are shown. Author

N76-15708* Lockheed Missiles and Space Co., Palo Alto, Calif.
ATS-5 OBSERVATIONS OF PLASMA SHEET PARTICLES BEFORE THE EXPANSION-PHASE ONSET, APPENDIX C.
K. Fujii (Tokyo Univ., Japan), A. Nishida (Tokyo Univ., Japan), R. D. Sharp, and E. G. Shelley *In its* Analysis of Data from the Lockheed Experiment on ATS-5 2 Sep. 1975 25 p refs (For availability see N76-15705 06-46)
CSCL 04A

Behavior of the plasma sheet around its earthward edge during substorms was studied by using high resolution (every 2.6 sec) measurements of proton and electron fluxes by ATS-5. In the injection region near midnight the flux increase at the expansion-phase onset is shown to lag behind the onset of the low-latitude positive bay by several minutes. Depending upon the case, before the above increase (1) the flux stays at a constant level, (2) it gradually increases for some tens of minutes, or (3) it briefly drops to a low level. Difference in the position of the satellite relative to the earthward edge and to the high-latitude boundary of the plasma sheet is suggested as a cause of the above difference in flux variations during the growth phase of substorms. Magnetograms and tables (data) are shown. Author

N76-15709*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
CALCULATION OF CONDUCTIVITIES AND CURRENTS IN THE IONOSPHERE
Volker W. J. H. Kirchhoff and Lynn A. Carpenter 28 Nov. 1975 47 p refs
(Grant NGL-39-009-003)
(NASA-CR-146082; PSU-IRL-SCI-439) Avail: NTIS HC $4.00
CSCL 04A

Formulas and procedures to calculate ionospheric conductivities are summarized. Ionospheric currents are calculated using a semidiurnal E-region neutral wind model and electric fields from measurements at Millstone Hill. The results agree well with ground based magnetogram records for magnetic quiet days. Author

N76-15710# Research Inst. of National Defence, Stockholm (Sweden).
A DISCRIMINATION PROBLEM FROM SEISMOLOGY
Eva Elvers Dec. 1975 23 p refs
(FOA-C-20080-T1) Avail: NTIS HC $3.50

Seismic discrimination between earthquakes and underground nuclear explosions was studied, utilizing magnitudes of two kinds from several seismic stations. A model was developed in which the mean values of the magnitudes are linear functions of a parameter describing event size. The model parameters can be estimated after a minor restriction of their space. For the case in which the discrimination rule is derived from the model, a few different approaches were considered and shown to coincide. It was found reasonable to use a discriminant which is linear in the magnitudes and explicit formulas were obtained. The power of the method was expressed by a measure of separation between the alternatives, which also showed the importance of the individual magnitudes. Missing data is a frequent problem in practice; the case was treated in which there is a detection threshold for one of the magnitudes. The rule was applied to the available magnitudes and classification probabilities were computed. Results depended on the event size. Author

N76-15711# Research Inst. of National Defence, Stockholm (Sweden).
SEISMIC EVENT IDENTIFICATION BY THE m SUB b(M SUB s)-METHOD
Eva Elvers Oct. 1975 30 p refs
(FOA-C-20070-T1) Avail: NTIS HC $4.00

The m sub b(M sub s)-method, which utilizes the magnitudes for body and surface waves from a seismic station to discriminate between earthquakes and underground nuclear explosions, is studied. The effects of the variation in time of the magnitude detection thresholds on the size-dependent classification probabilities is considered. The mean values of these are obtained as a summarizing measure of capability for long time use, and an alternative classification procedure based on these means is discussed. The process of earthquakes is described by a model, which is in accordance with the generally assumed distribution of body wave magnitudes, and a method to estimate involved parameters is given. If the classification principle is changed to specifying the chosen summarizing measure, the mean rate of false alarms, it is no longer possible to obtain a strict increase of the probability to classify an explosion correctly by including identification by negative evidence. The decrease for large yields may, however, be small compared with the improved applicability. Author

N76-15712# Institut Royal Meteorologique de Belgique, Brussels.
OZONE OBSERVATIONS Quarterly Report, 1972 [OBSERVATIONS D'OZONE]
1975 57 p refs In FRENCH and DUTCH
(QR-1) Avail: NTIS HC $4.50

Spectrophotometric ozone measurements are reported for the first quarter of 1972. The presented ozonograms contain designations for partial ozone pressure and atmospheric diffusion, air temperature, and used wavelengths. ESA

N76-15713# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
DOUBLE LAYERS
Lars P. Block May 1975 23 p refs Presented at the Nobel Symp. on the Phys. of the Hot Plasma in the Magnetosphere, Kiruna, Swed., 2-4 Apr. 1975
(TRITA-EPP-75-10) Avail: NTIS HC $3.50

The basic properties of electrostatic double layers observed in laboratory gaseous discharges are reviewed. Theoretical results from both macroscopic 4-fluid theory and microscopic, Vlasov, theory are described and found to be in fairly good agreement. Recent work on Penrose-stable double layers, as well as double

layers with oblique electric and magnetic fields are described. Applications to Birkeland currents in the ionosphere are made. It was found that kilovolt potential which drops along the geomagnetic field can be produced in the topside ionosphere by double layers. Anomalous turbulent resistivity effects are unlikely to produce large parallel potential drops since that would lead to excessive heating of the ambient plasma. Since double layers are laminar structures they will not produce heat until the accelerated particles are stopped in the lower much denser E-layer. Author (ESA)

N76-15714# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

ELECTRON PRECIPITATION IN THE MORNING SECTOR OF THE AURORAL ZONE

V. Jentsch (Max-Planck-Inst. fuer Aeronomie) May 1975 50 p refs Submitted for publication Sponsored by ESA

(TRITA-EPP-75-15) Avail: NTIS HC $4.00

Auroral electron precipitation in the morning sector is discussed. The precipitation is assumed to be the result of an electro-magnetic cyclotron instability of a particle distribution that evolves adiabatically as its constituent electrons drift eastward from a source near midnight. The adiabatic distribution was calculated by Green's function methods in various magnetospheric field models, and the corresponding growth rates for whistler mode waves were calculated by the method of Kennel and Petschek. The region of maximum calculated wave growth corresponds spatially and temporally to the region of maximum observed electron precipitation only when the magnetospheric electric field is included realistically in the model. Author (ESA)

N76-15715# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.

DATA ANALYSIS AND RESULTS OF THE SPAZ MAGNETOMETER EXPERIMENT Final Report [AUSWERTEVERFAHREN UND ERGEBNISSE DES SPAZ-MAGNETOMETEREXPERIMENTES]

Gernot Stremming and Burkhard Theile Bonn Bundesmin. fuer Forsch. und Technol. May 1975 77 p refs In GERMAN; ENGLISH summary

(Contract WRK-203)

(BMFT-FB-W-75-08) Avail: NTIS HC $5.00; ZLDI, Munich DM 16,20

Experiments accomplished with an induction coil magnetometer were flown onboard two sounding rockets to detect the magnetic fields of polar electrojets arising in a substorm. The instrumentation and data evaluation procedure are described. Data evaluation was made in such a way as to eliminate rocket spin originated modulation by filtering it off from the output signal of the probe. Nutation effects were counteracted by more elaborate approximations. ESA

N76-15716# Bonn Univ. (West Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung.

EXOSPHERIC DENSITY AND DENSITY VARIATION DETERMINED FROM ORBIT PERTURBATIONS OF THE ECHO 1 SATELLITE [DICHTE UND DICHTEVARIATION DER EXOSPHAERE BERECHNET AUS BAHNAENDERUNGEN DES SATELLITEN ECHO 1]

Norbert Witt Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1975 123 p refs In GERMAN; ENGLISH summary

(Contracts WRK-253; GfW-RV-I-1-B-8/73-SE-11)

(BMFT-FB-W-75-10) Avail: NTIS HC $5.50; ZLDI, Munich DM 25,85

Atmospheric densities were determined for selected time intervals from the orbital perturbations of the Echo 1 balloon satellite. An objective, reproducible method was employed to approximate the mean anomaly residuals. The effect of earth albedo and solar radiation pressure on the orbital motion were taken into account. In the examined height range of 900 to 1050 km drag-deduced densities were found to be consistently lower than was to be expected from the 1971 static diffusion model especially at solar minimum. Total densities are compared to those deduced from the drag data of the Echo 2 satellite. The densities show a positive correlation with solar 10.7 cm flux. Six magnetic storm events were analyzed in detail to determine the course and response time of exospheric density variations with respect to geomagnetic fluctuations. In all cases increased geomagnetic activity was found to correspond to increases in density. Density changes deduced from Echo 1 data are compared to those encountered by satellites at lower altitude during the same geomagnetic disturbances. Author (ESA)

N76-15717# Bonn Univ. (West Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung.

DETERMINATION OF ALTITUDE DEPENDENCE OF THE EXOSPHERIC ROTATION ABOVE 350 KM [BESTIMMUNG DER HOEHENABHAENGIGKEIT DER EXOSPHAERISVHEN ROTATION OBERHALB 350 KM]

Klaus G. H. Schuchardt Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1975 132 p refs In GERMAN; ENGLISH summary

(Contracts WRK-253; GfW-RV-I-1-B-8/73-SE-11)

(BMFT-FB-W-75-11) Avail: NTIS HC $6.00; ZLDI, Munich DM 27,75

The theory of determining mean thermospheric zonal winds above 150 km by analysis of the inclination change of satellites is discussed. The decrease of upper-atmospheric rotation rate from 1.4 times the earth's angular velocity at a height of 375 km to 0.7 at 500 km, from the analysis of only three satellite orbits, was derived without eliminating the effects of solar radiation pressure. These satellites do not allow the exact computation of radiation pressure effects due to their irregular shape. Therefore the orbit of the balloon satellite Explorer 24 (1964-76A) has been thoroughly analyzed at perigee heights between 480 and 600 km and during various time intervals. A computer program was developed for this purpose, which directly computes the zonal wind magnitude with regard to all significant perturbations using the method of least squares. The parts of the program which compute the radiation pressure effects have previously been tested with the aid of the orbit of the balloon satellite Dash 2 (1963-30D). The results from Explorer 24 could be changed by altering the investigated time intervals. Altogether they indicate a corotation of the atmosphere and the earth at heights of 550 to 600 km. A local time dependence of zonal winds in this height region could not be detected. Author (ESA)

N76-15718# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

MAGNETOSPHERE - IONOSPHERE INTERACTIONS: SOME SIGNIFICANT ACHIEVEMENTS 1973 - 1975

Rolf Bostroem May 1975 17 p refs Presented at the 16th Gen. Assembly of the Intern. Union of Geodesy and Geophys., Grenoble, France, Aug.-Sep. 1975

(TRITA-EPP-75-17) Avail: NTIS HC $3.50

Some phenomena directly related to the magnetosphere-ionosphere interaction processes are discussed, in particular those pertaining to the field lines coupling the ionosphere to the magnetosphere. The large scale characteristics of Birkeland currents, which flow along the magnetic field lines, are reviewed. The small-scale structure of Birkeland currents is discussed in association with energetic particle fluxes and auroral forms. The role of Birkeland currents of ionospheric origin is mentioned. Theories and observations related to parallel electric fields caused by Birkeland currents are reviewed. ESA

N76-15719# Kiruna Geophysical Observatory (Sweden).

STUDIES OF AURORAL INFRASONIC WAVES IN THE 0.1-0.01 Hz RANGE

Hans Westin Sep. 1975 19 p refs

(KGI-75-1) Avail: NTIS HC $3.50

Registrations of low frequency infrasonic waves coming from the aurora were made at Kiruna using a microphone array. During a 16 month period 186 Auroral Infrasonic Waves (AIW) were detected of an impulsive nature with periods of 40 sec and peak to peak amplitudes of 47 N/sq m. The spread in azimuth of arrival around the magnetic meridian was plus or minus 120 deg but 97% came from 340 deg plus or minus 90 deg. Thus no AIW came from the south, which confirms Wilson's observations in Alaska. ESA

N76-15720# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.

STRONG MOTION EARTHQUAKE ACCELEROGRAMS. DIGITIZED AND PLOTTED DATA. VOLUME 1: UNCORRECTED ACCELEROGRAMS. PART X: ACCELEROGRAMS

IX355 THROUGH IX369. ACCELEROGRAMS FROM THE SAN FERNANDO, CALIFORNIA, EARTHQUAKE OF 9 FEBRUARY, 1971

A. G. Brady and D. E. Hudson Apr. 1975 130 p refs
(Grant NSF GI-28098)
(PB-243594/9; EERL-73-29) Avail: NTIS HC $6.00 CSCL 08K

Data are presented from the Lytle Creek, California, earthquake of September 12, 1970. Records are included from the buildings at 1640 Marengo, the Department of Water and Power, 808 S. Olive, and 646 S. Olive in Los Angeles; the building at 445 Figueroa in Los Angeles; and the Fire Station No. 78, a CWR site at Lake Hughes, No. 1. GRA

N76-15721# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.

STRONG MOTION EARTHQUAKE ACCELEROGRAMS. DIGITIZED AND PLOTTED DATA. VOLUME 2: CORRECTED ACCELEROGRAMS AND INTEGRATED GROUND VELOCITY AND DISPLACEMENT CURVES. PARTS W AND Y: ACCELEROGRAMS 2W334-2W336, 2W338, 2W339, 2W342-2W345 AND 2Y370-2Y381

D. E. Hudson, A. G. Brady, and M. D. Trifunac Apr. 1975 263 p refs
(Contract NSF AEN-71-01825)
(PB-243719/2; EERL-75-53) Avail: NTIS HC $9.00 CSCL 08K

The first set of twenty corrected earthquake accelerograms was published in September 1971, as Volume 2, Part A, Report No. EERL71-50. That issue also contained introductory material and background information describing the types of corrections used. The corresponding uncorrected data appeared earlier in Volume 1, Part A, Report No. EERL 70-20. Both of these reports, containing references related to the records themselves and the various procedures, should be referred to by all users of the data. This issue, Volume 2, Parts W and Y, Report No. EERL 75-53, is the last of this series of reports, and contains records from two Southern California earthquakes: Lytle Creek, September 12, 1970, and Borrego Mountain, April 8, 1968. GRA

N76-15722# National Science Foundation, Washington, D.C. Office of Polar Programs.

PROBLEMS OF THE ARCTIC AND ANTARCTIC. NUMBER 41, 1973

A. F. Treshnikov 1975 157 p refs Transl. into ENGLISH from Probl. Arktiki i Antarktiki Sbornik statei (USSR), no. 41, 1973
(TT-74-52009) Avail: NTIS HC $6.75

Diverse problems of hydrometeorology are considered. The problems include finding the relationship of the elementary hydrologic and synoptic processes, sea level fluctuations according to calendar peculiarities, statistical analysis of the effect of wind fields on the level of arctic seas and meridional components of wind velocity at different varieties of atmospheric circulation forms. Attention has been paid to the conditions of ice formation in the arctic seas, crystal structure of sea ice, specific energy of mechanical crushing of ice by impact, annual cycle of ice cover thickness variation, and ice temperature during thawing. These investigations have contributed greatly to the understanding of the phenomenon of ice formation. GRA

N76-15723# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

AEROMETHODS IN GEOCRYOLOGY

I. V. Protaseva Jul. 1975 189 p refs Transl. into ENGLISH from mono "Aerometody v Geokriologii" Moscow, 1967 196 p
(AD-A014143; CRREL-TL-482) Avail: NTIS CSCL 08/12

The book discusses the use of aeromethods for studying the development of permafrost soils (rocks) and permafrost phenomena connected with them. Theoretical and methodical conclusions were drawn which can be used as a basis for a further broader adoption of aeromethods into the practice of regional and topical studies of the tendencies in the distribution, composition, structure and properties of permafrost soils. GRA

N76-15724# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

PERENNIAL CRYOLITHIC ZONE

A. A. Sharbatyan Jul. 1975 9 p refs Transl. into ENGLISH from Bolshaya Sovetskaya Entsiklopedia (USSR), v. 16, 1974 columns 1098-1103
(AD-A014147; CRREL-TL-484) Avail: NTIS CSCL 08/12

The perennial cryolithic zone is an upper layer of the earth's crust characterized over a period of many years by a stable negative or zero temperature ensuring year-round and prolonged preservation of underground ice. The article briefly discusses this zone. GRA

N76-15725# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

DIGITAL FILTERS FOR EARTHQUAKE SITE STUDIES Final Report, Fiscal Year 1973 - 1974

Hendrik D. Carleton Jul. 1975 43 p refs
(AD-A014194; AEWES-TR-N-75-3) Avail: NTIS CSCL 08/11

The objective of this study was to develop a computerized technique for processing strong-motion accelerograms from earthquakes in order that earthquake vulnerability for existing structures can be more fully investigated through the use of simplified base excitations. Through filter theory, the Wiener normal equations were used to reduce accelerogram pairs to basic time histories called operators. This approach isolates the differences contained within accelerogram pairs from project sites at which the data were obtained. The operators are used with mathematical shocks (such as half-sine pulses) as inputs to produce simplified responses. Variations in the simplified responses are obtained by changing the durations of the half-sine or other hypothetical wave form inputs and using the same operator for each variation. Each family of responses is then studied to determine its sensitivity to these changes. As an example of this theory, data from an earthquake of magnitude 4.4 + or - were used to construct operators that related free-field motions to those on the main and auxiliary dams at the Isabella Reservoir near Bakersfield, California. Based on the results of this study, it is concluded that use of this technique should enable structural engineers to assess earthquake vulnerability for existing structures more fully, and that this in turn could lead to improvements in future designs. GRA

N76-15726# National Environmental Satellite Service, Washington, D.C.

DEPENDENCE OF VTPR TRANSMITTANCE PROFILES AND OBSERVED RADIANCES ON SPECTRAL LINE SHAPE PARAMETERS

Charles Braun Jul. 1975 23 p refs
(COM-75-11234/2; NOAA-TM-NESS-70; NOAA-75081201) Avail: NTIS HC $3.50 CSCL 04A

The sensitivity of transmittance profiles and radiances to spectral line shape and line strength was calculated for the spectral intervals of the Vertical Temperature Profile Radiometer (VTPR). For 15 degrees N, the change in calculated radiance became equal to the permissible design noise level of the instrument in attendance by 12%, or the line strength by 1%. If the variations in the concentration of atmospheric CO2 are ignored and a constant value is used the error in calculated radiance exceeds the design noise level in several spectral channels in the profile of 15 degrees N and is close to the design noise level for one channel in the profile of 60 degrees N. The permitted variations in spectral line strength and line shape parameters are found to be considerably less than the uncertainty of the values determined by laboratory measurement. GRA

N76-15727# Aeronomy Corp., Champaign, Ill.

REMOTE DIAGNOSTICS AND CORRELATION ANALYSIS FOR PRAIRIE SMOKE Final Technical Report, Apr. 1973 - Mar. 1974

S. A. Bowhill and E. K. Walton Jul. 1975 134 p refs
(Contract F30602-73-C-0178; ARPA Order 1423)
(AD-A014434; RADC-TR-74-182) Avail: NTIS

The disturbed ionospheric region produced by the Platteville heating transmitter facility was studied by the use of orbital and geostationary satellite signals. It was found that the modifier transmitter produces an ellipsoidal disturbed region with an e-folding radius of about 50 km. This region is centered at the

height of maximum of the ionospheric layer and displaced about 30 km north of the transmitter. The disturbed region is made up of geomagnetic field-aligned irregularities, having e-folding radius normal to the magnetic field of 75 to 400 m (the larger values are at night). They drift with the neutral wind with velocities of 8 to 25 m/s. These disturbances cause scintillations as high as 25 percent in a VHF radio signal transmitted through it when the line of sight approaches the direction of the magnetic field. GRA

N76-15728# Frankford Arsenal, Philadelphia, Pa.
PGAUSS-LT: A PROGRAM FOR COMPUTING OPTICAL PROPERTIES OF SINGLE SCATTERING AEROSOL CLOUDS OF HOMOGENEOUS PARTICLES
Edward W. Stuebing, James J. Pinto, and Richard B. Gomez Apr. 1975 33 p refs
(DA Proj. 1G7-63726-D-471)
(AD-A014162; FA-TM-75019) Avail: NTIS CSCL 04/1

The main purpose of PGAUSS-LT is to enable the user to compute luminous trasmittance over nonhomogeneous atmospheric paths containing an arbitrary size and number density of liquid and solid particles. The absorbing and scattering particles are assumed to be homogeneous, isotropic spherical particles made up of a material whose complex refractive index is known along with the real index of the surrounding medium. The modifications made to PGAUSS provide for (1) suppressing much of the detailed PGAUSS output and a slight change in the definition of the phase function, (2) calculating optical density per meter within the system of particles at specified wavelengths as a function of number density, (3) calculating luminous transmittance over various path lengths as a function of number density, (4) providing interpolation of the phase function over angular regions specified in the input, and (5) providing integration under the phase function over the angular regions. GRA

N76-15729# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
THE VERTICAL FINE STRUCTURE OF STRATOSPHERIC TEMPERATURE Final Report, 1 Apr. 1972 - 31 Jul. 1973
H. T. Mantis Aug. 1975 39 p refs
(Contract N00014-67-A-0113-0031)
(AD-A014258; TR-1; TR-2; TR-3) Avail: NTIS CSCL 04/1

This document contains reports on the following topics: (1) Variation in the Balloon Rate of Ascent and its Effect on the Measurement of Atmospheric Structure; (2) On the Curvature of the Temperature Profile at the Tropopause; and (3) Unstable Layers in the stratosphere and the Process of Vertical Mixing. GRA

N76-15730# Naval Research Lab., Washington, D.C.
THE AERONOMY OF ODD NITROGEN IN THE THERMOSPHERE. 2: TWILIGHT EMISSIONS
Darrell F. Strobel, Elaine S. Oran, and P. D. Feldman (Johns Hopkins Univ.) Jul. 1975 41 p refs
(NRL Proj. A03-16; RR0330242)
(AD-A014207; NRL-MR-3090) Avail: NTIS CSCL 04/1

The previously developed model by Oran et al. (1975) for the aeronomy of odd nitrogen in the thermosphere is used to analyze AE data on N(doublet D) and NO published by Rusch et al. (1975) and the twilight NO emission data of Feldman and Takacs (1974). It is concluded that most NO(+) dissociative recombination events must produce N(doublet D), that N(doublet D) is quenched by O with a rate of 1 x 10 to the 12th power cc/sec, and that the atmospheric O2 quenching rate of N(doublet D) is consistent with the laboratory rate. The major quenching agent of N(doublet D) between 140 and 220 km is atomic oxygen, and this reaction is the major source of N(quadruplet S). The authors predict peak N(quadruplet S) densities about (2-6) x 10 to the 7th power/cc at 140-150 km, with the variability indicative of the model sensitivity to a factor of 2 change in the O/O2 ratio in the thermosphere. The model accurately simulates the twilight emission data of Feldman and Takacs (1974). GRA

N76-15731# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INFRARED LABORATORY SPECTROSCOPY IN SUPPORT OF STRATOSPHERIC MEASUREMENTS Final Report, 1 Oct. 1974 - 30 Jun. 1975
Robert A. Toth 1975 8 p
(Contract DOT-AS-20094)
(PB-244831/4) Avail: NTIS HC $3.50 CSCL 04A

The objective of this laboratory study is to determine the spectral characteristics (line center frequencies, line strengths and pressure-broadened linewidths) for several molecules that are present in the earth's stratosphere and are of particular interest to the Climatic Impact Assessment Program of the U.S. Department of Transportation. The molecules investigated are: CH4, N2O, H2CO, NO2, and H2O. GRA

N76-15732*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIDAR SUPPORT FOR THE LACATE BALLOON EXPERIMENT Final Report
E. E. Remsberg, G. B. Northam, W. H. Fuller, Jr., and M. P. McCormick Jan. 1975 16 p refs
(NASA-TM-X-72956; PB-244464/4) Avail: NTIS HC $3.50 CSCL 04A

This report presents LIDAR data taken on the morning of May 5, 1974, at San Angelo, Texas, in support of the LACATE balloon test. To determine the success of the balloon package in measuring stratospheric temperature and pollutant concentrations, it is desirable to have other measurements of these same quantities. The purpose of the LIDAR measurements was threefold. First, LIDAR detection of particulate backscatter profiles may be intercompared with background horizon radiances from a radiometer channel centered at 10.8 micrometers. Secondly, LIDAR data is a more continuous indicator of stratosphere aerosol loading and can be used to verify data obtained with particle samplers on aircraft and dustsondes. The third objective was an expected comparison of aerosol profiles with those inferred from limb extinction data gathered by the SAM II photometer. However, this latter experiment failed after launch. Calibration between the LIDAR and a dustsonde is also discussed. GRA

N76-15733*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET MEASUREMENTS OF OZONE AND RELATIVE SOLAR IRRADIANCE PROFILES Final Report
A. J. Krueger May 1975 41 p refs
(Contract DOT-AS-20056)
(NASA-TM-X-72954; PB-244465/1) Avail: NTIS HC $4.00 CSCL 04A

Optical ozonesondes were launched on Arcas rockets in four experiments as part of the Climatic Impact Assessment Program. Ozone profiles were computed from measurements of ultraviolet sunlight in four bands absorbed by ozone. Two flights from Antigua, West Indies (17 degrees N) and one flight from White Sands Missile Range, New Mexico (32 degrees N) were made in conjunction with CIAP WB57 aircraft overpasses at 20 km. The remaining flight, from White Sands Missile Range was made for comparison with LACATE balloon measurements. The Antigua soundings showed an almost equatorial profile in June, 1973 with a mixing ratio maximum of 16 microgm/gm at 32 km and a mid-latitude type profile in January 1974. The White Sands flights on May 5, 1974 produced profiles with mid-latitude characteristics which showed an apparent 15% increase from the first to the second flight at heights above 41 km. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-15734*# Kansas Univ., Lawrence. Space Technology Labs.
TOWARD PROOF OF SATELLITE ANEMOMETER CONCEPT Final Report, 1 Dec. 1972 - 30 Jun. 1973
John Classen 30 Jun. 1973 13 p refs
(Contract NAS9-13356)
(NASA-CR-146076) Avail: NTIS HC $3.50 CSCL 14B

The S-193 oceanographic program is designed to demonstrate the operational feasibility of measuring ocean surface winds on a global basis with a composite radar-radiometer sensor.

Near-simultaneous radiometric/scatterometric measurements offer a better opportunity to make improved estimates of surface winds through a variety of atmospheric conditions. Support is presented in developing interpretational techniques for the joint measurements, designing experiments to verify the joint interpretation techniques, predicting the observations from theory, evaluating system effects on the measurements, and developing system design criteria. Author

N76-15735# Institut Royal Meteorologique de Belgique, Brussels.
PRINCIPAL CHARACTERISTICS OF RAINFALL AT COXYDE, MELSBROOK AND SAINT HUBERT DURING THE PERIOD 1952 - 1972 [LES PRINCIPALES CARACTERISTIQUES DES PRECIPITATIONS A COXYDE, MELSBROEK ET SAINT-HUBERT PERIODE DE REFERENCE: 1952-1972]
A. Bodeux 1972 65 p ref In FRENCH and DUTCH
(Misc-Ser-B-29) Avail: NTIS HC $4.50

Different kinds of precipitation observed are enumerated and their frequency given. Number of days, daily moments of highest frequency, duration, level, and intensity of precipitation as well as wind direction and velocity and horizontal visibility during precipitation are tabulated for three representative climatological stations in Belgium. ESA

N76-15736# Royal Netherlands Meteorological Inst., De Bilt.
ELABORATION OF A TOOL IN FORECASTING FOG FOR SCHIPHOL AIRPORT [UITWERKING VAN EEN HULPMIDDEL BIJ HET VOORSPELLEN VAN MIST VOOR DE LUCHTHAVEN SCHIPHOL]
A. W. Hanssen 1975 17 p refs In DUTCH
(KNMI-V-262) Avail: NTIS HC $3.50

Results are presented of an investigation to increase the statistical aids for fog forecasting at Schiphol airport. Taylor diagrams were further developed and resulted in a set of diagrams with which a verdict can be given about the probability of fog at 17, 20 and 23 GMT 2 hours in advance. ESA

N76-15737# Royal Netherlands Meteorological Inst., De Bilt.
A PRELIMINARY INVESTIGATION OF THE RELATION BETWEEN THE FLIGHT OF PEACH PLANT LICE AND A NUMBER OF METEOROLOGICAL PARAMETERS [EEN ORIENTEREND ONDERZOEK NAAR HET VERBAND TUSSEN DE VLUCHT VAN PERZIKBLADLUIZEN EN EEN AANTAL WEERFAKTOREN]
G. J. Yperlaan 1975 26 p In DUTCH
(KNMI-V-264) Avail: NTIS HC $4.00

An investigation was carried out to determine a possible relation between weather and plant lice catches, and which meteorological parameters are of influence. Catch numbers were determined for a period of 11 years independent of population density. Only 156 useful catch numbers were found due to various conditions. If one assumes a relation between catch numbers and meteorological conditions, the catch numbers are probably antipersistent. A clear relation was found between wind velocity and precipitation on the one hand, and catch numbers on the other. The upper limit of the catch numbers decreases exponentially with increasing precipitation, and respectively, with increasing wind velocity. Temperature and cloud cover probably also affect the catch. ESA

N76-15738# National Center for Atmospheric Research, Boulder, Colo.
COMPUTATION OF POSSIBLE CLIMATIC CONSEQUENCES OF PERTURBATIONS TO STRATOSPHERIC AEROSOLS, OZONE AND WATER VAPOR WITH RADIATIVE-CONVECTIVE MODELS Final Report
J. A. Coakley, S. H. Schneider, and R. E. Dickinson 27 Jun. 1975 24 p refs
(Contract DOT-AS-40033)
(PB-244476/8) Avail: NTIS HC $3.50 CSCL 04A

A summary is presented of the results of experiments performed using a new radiative-convective model developed as part of the CIAP funded research. The experiments tested the sensivity of the thermal structure of the atmosphere to changes in the solar 'constant'; the stratospheric ozone profile; and the concentration of water vapor in the stratosphere. The findings agree qualitatively with the earlier results obtained by Manabe and Wetherald (1967) and Callis et al. (1975) and to the extent that results from different models should be compared, the quantitative agreement is also good. In addition the results of a simple energy balance model which can be used to estimate the sensitivity of the global mean surface temperature to changes in the stratospheric aerosol layer are reported. This model, also developed for this CIAP study, includes the effects of the particles on both solar and terrestrial radiation and reveals a coupling between the planetary albedo, the stratospheric aerosol layer, and the surface temperature that was overlooked during the CIAP time frame. GRA

N76-15739# National Climatic Center, Asheville, N.C.
INITIAL WIND ENERGY DATA ASSESSMENT STUDY
Michael J. Changery May 1975 132 p refs Proc. of the Data Assessment, Ashville, N. C., 29-31 Jul. 1974
(Grant NSF AG-517)
(PB-244132/7; NSF/RA/N-75-020) Avail: NTIS HC $6.00 CSCL 04B

During a 3-day meeting held at the National Climatic Center on July 29-31, 1974, discussions were held on data availability, vertical and horizontal extrapolation problems and techniques, turbulence and gust effects, additional data requirement and remote sensing techniques. The discussion, recommendations and conclusions of that meeting are summarized and the results of the survey of existing and available data are presented. The report is divided into two sections; the first on meteorological data requirements and technique assessments, and the second on the wind data survey. GRA

N76-15740# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
NOAA MARK 7 ACOUSTIC ECHO SOUNDER
Edward J. Owens Jun. 1975 79 p refs
(COM-75-11123/7; NOAA-TM-ERL-WPL-12; NOAA-75072308) Avail: NTIS HC $5.00 CSCL 04B

The NOAA Mark 7 portable acoustic echo sounder which consists of a central unit, power amplifier, facsimile recorder, and four-ft. parabolic reflector antenna, and which is used to monitor atmospheric temperature structure (inversions and convective plumes) to a height of 1360 m, by measuring backscattered echoes from acoustic tone bursts, is described. The theory and operation of the system were stressed. Complete instructions for initial setup, adjustment and calibration, startup, shutdown, and maintenance are given. Appendices include wiring diagrams, design and operation of electronics subsystems, modifications to system, parts lists, and schematic diagrams of circuits. GRA

N76-15741# Washington Univ., Seattle. College of Forest Resources.
EVAPOTRANSPIRATION OF FOUR FOREST TYPES MEASURED WITH THE EDDY CORRELATION TECHNIQUE Project Completion Report, Jul. 1973 - Jun. 1975
Leo J. Fritschen, H. Richard Holbo, and Milton O. Smith 24 Jun. 1975 26 p refs
(Contract DI-14-31-0001-4048)
(PB-244695/3; W75-11044; OWRT-A-061-WASH(1)) Avail: NTIS HC $4.00 CSCL 04B

Eddy correlation instrumentation for evapotranspiration estimation from forest canopies was evaluated. The frequency response of the Gill-type propeller is probably adequate for obtaining vertical windspeeds, but fine glass-bead thermistors are not fast enough to capture the temperature fluctuations. A fluxatron for the direct assessment of the sensible heat flux was designed and built. In comparison with covariance and cospectral computations made from high frequency data, the fluxatron exhibited a good potential for independently forming and outputing flux estimates. Spectral analyses of the turbulence above the canopy show a wide range of frequencies, extending much lower in frequency than those normally reported. As a consequence, the bandwidth of the fluxatron must be increased. GRA

N76-15742# Texas A&M Univ., College Station.
EFFECT OF PRECIPITATION DRIVEN DOWNDRAFT ON A ROTATING-WIND FIELD: A POSSIBLE TRIGGER MECHANISM FOR TORNADOES Final Report
Robert E. Eskridge and Phanindramohan Das 30 Sep. 1974

104 p refs
(Grant NOAA-04-3-022-25)
(COM-75-11239/1; NOAA-75081204) Avail: NTIS HC $5.50 CSCL 04B

The physical and dynamical effects of simulated precipitation in a rotating-wind field are examined. The basis of these experiments lies in the results obtained in one-dimensional, adiabatic models of precipitating cumuli. These models confirm that the downdraft is unsaturated since the precipitation-size drops evaporate little and the downdraft warms up at a rate close to that of adiabatic compression. Consequently, a downdraft descending into a stable environment would tend to be warmer than its surroundings. The results also show that vorticity is concentrated by the precipitation-induced, accelerating downdraft which, descending dry-adiabatically, becomes warmer than the air outside of the downdraft because the lapse rate of potential temperature in the environmental air is assumed close to moistadiabatic. Near the surface, the air in the downdraft attains sufficient positive buoyancy to overcome the negative buoyancy of the precipitation and begins to be accelerated upward. The accelerating updraft is accompanied by horizontal inflow near the surface that acts to concentrate vorticity in the lower part of the region near the axis. GRA

N76-15743# Oklahoma Univ. Research Inst., Norman. Atmospheric Research Lab.
INFLECTION POINT INSTABILITY WITHIN A LAYER Interim WEAT Report, 1 Oct. 1973 - 30 Sep. 1974
Kit K. Wagner Sep. 1974 81 p refs
(Grants NOAA-04-4-022-18; NOAA-04-3-022-9)
(COM-75-11237/5; WEAT-15; NOAA-75081110) Avail: NTIS HC $4.75 CSCL 04B

Three cases of the dissipation of nocturnally formed surface inversions were examined with the meteorological data from the National Severe Storms Laboratory tower. Two cases, 25 and 28 October 1971, had large temperature fluctuations at the base of the inversion. The mean wind profile up to the inversion top was approximately an Ekman spiral. The third case, 21 October 1971, had much smaller temperature fluctuations in the inversion and the mean wind profile had little resemblance to an Ekman spiral. The analysis of data showed the development of an Ekman wind profile under stable conditions; secondly, the creation of a less stable lower region by surface warming; and thirdly, the initiation of strong mixing at inversion base due to inflection point instability when the less stable air reaches the height of the inflection point in the wind profile. The intense mixing at inversion base causes the large observed temperature fluctuations. GRA

N76-15744# National Hurricane Center, Miami, Fla.
HURRICANE EXPERIENCE LEVELS OF COASTAL COUNTY POPULATIONS: TEXAS TO MAINE
Paul J. Herbert and Glenn Taylor Jul. 1975 162 p refs
(COM-75-11218/5; NOAA-75082102) Avail: NTIS HC $6.75 CSCL 04B

Population graphs for the period 1900-1970 have been prepared for coastal counties from Texas to Maine which could be affected significantly by hurricane winds and/or tides. The Saffir/Simpson Hurricane Scale (range 1-5) has been used to develop a hurricane climatology for each county for the period 1900-1974. The combined statistics graphically illustrate that over 75% of all Atlantic and Gulf coastal residents of the United States have never experienced the effects of a direct hit by a major hurricane. GRA

N76-15745# National Weather Service, Fort Worth, Tex.
A SATELLITE CLASSIFICATION TECHNIQUE FOR SUBTROPICAL CYCLONES
Paul J. Herbert and Kenneth O. Poteat Jul. 1975 30 p refs
(COM-75-11220/1; NOAA-TM-NWS-SR-83;
NOAA-75082039) Avail: NTIS HC $4.00 CSCL 04B

The Dvorak technique for estimating the intensity of tropical cyclones from satellite pictures is frequently inapplicable for subtropical cyclones. A new technique which gives not only the intensity but also the type (tropical, subtropical) of cyclone has been derived, using guidelines similar to the Dvorak scheme, so that the two systems will intermesh when cyclones change type. These guidelines were evaluated by Miami Satellite field Services Station meteorologists for a data sample of 32 cases (27 subtropical) for the period Mue, as well as a successful meshing of the two techniques, and the ability to distinguish between the two types of cyclones. GRA

N76-15746# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
COST BENEFITS METHODS AND THE EVALUATION OF CLIMATIC CHANGE Final Report
George Daly Jun. 1975 51 p refs
(Contract DOT-OS-30057)
(PB-244824/9; P-1114) Avail: NTIS HC $4.50 CSCL 04B

The economic effects of climate change are analyzed and the ways in which economists attempt to measure such effects, particularly with cost benefit analysis. It is concluded that many of these methods are inappropriate as measures of the resource allocation effects of climate change and tend to overstate the associated costs because they ignore the adaptability of the economy to such changes. Methods of compensating cost benefit analyses for this defect are suggested. GRA

N76-15747# Colorado State Univ., Fort Collins. Environmental Resources Center.
ANALYSIS OF COLORADO PRECIPITATION
Marie Kuo and Stephen K. Cox Jun. 1975 44 p refs Sponsored by the Dept. of Interior
(OWRT Proj. A-018-COLO(2))
(PB-244717/5; Completion-63; W75-11040) Avail: NTIS HC $4.00 CSCL 04B

The precipitation trend in Colorado was studied statistically using 56 years of data collected at 61 stations. The precipitation had an annual decrease of 0.01 inches over the 56 year period although this result was not statistically significant. Precipitation periods (referred to as storms) were used to describe the variation of the precipitation in space and time. The state of Colorado was divided into six geographic regions, and area weighted hourly precipitation data were summed to obtain the volume of water yielded by each storm. GRA

N76-15748# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
FURTHER STUDIES ON THE ORIGIN OF HURRICANES
Herbert Riehl Feb. 1975 25 p refs
(Grant NOAA-N22-31-72(G))
(COM-75-11226/8; AS-Paper-235) Avail: NTIS HC $3.50 CSCL 04B

While there is no question that release of latent heat of condensation is a major factor in driving mature hurricanes, uncertainty has remained about its role in hurricane formation and the cause of large intensity increases sometimes experienced by a hurricane which had persisted on some plateau for several days. It has previously been hypothesized by the author that hurricane initial intensification is often related to a one to two day prior increase of upper tropospheric baroclinicity 500-1000 km around the pre-cyclone disturbance. This prior increase of upper level baroclinicity is usually associated with a traveling middle-latitude westerly cyclone. A number of recent year examples in the West Indies is presented. GRA

N76-15749# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Electro-Optics and Reconnaissance Branch.
CLOUD COVER STATISTICS FOR MOUNT HALEAKALA, HAWAII FOR THE PERIOD: MAY 1972 - DEC. 1974
James K. Lyon, Jr. Jul. 1975 54 p refs
(AD-A014251; AFAL-TR-75-61) Avail: NTIS CSCL 04/2

This report contains information on the cloud cover statistics and estimated percent probabilities of cloud-free line-of-sight. The wind speed/direction and relative humidity data for the same 32 months period are given. However, due to the location of the instrumentation to measure these parameters, no attempt was made to summarize these data. GRA

N76-15750# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACCURACY OF HUMIDITY MEASUREMENT IN THE SOVIET RKS-2 RADIOSONDE
J. Rink 1 Aug. 1975 15 p refs Transl. into ENGLISH from Z. Meteorol. (East Germany), v. 23, no. 9, 1973 p 275-279

(AD-A014406; FTD-ID(RS)I-1793-75) Avail: NTIS CSCL 04/2

In the Soviet RKS-2 radiosonde a goldbeater's skin hygrometer is used for measuring humidity. To check its long-term stability, which of course is highly dependent on the history or aging of the measurement elements, there recently was presented an opportunity to examine a large number of goldbeater's skin hygrometers of a sonde delivery some three years old in relationship to their storability and the reproducibility of calibration values. The results obtained are reported. GRA

N76-15751# Army Electronics Command, Fort Monmouth, N.J.
MESOSCALE WIND SHEARS DERIVED FROM THERMAL WINDS
Jul. 1975 21 p refs
(DA Proj. 1T1-62111-AH-71-A-266)
(AD-A014155; ECOM-5566) Avail: NTIS CSCL 04/2

An experiment was conducted at White Sands Missile Range, New Mexico, during the period August 1973 through March 1974 to test the validity of the hypothesis that the thermal wind equation is valid on the mesoscale. Data from nearly three hundred radiosondes were edited and analyzed. The results indicate that the hypothesis is true except in the vicinity of the tropopause. Details of the editing and analysis procedures are presented in the paper along with the results. GRA

N76-15752# General Electric Co., Santa Barbara, Calif. DASIAC.
REACTION RATE DATA, NUMBER 51
Apr. 1975 23 p
(Contract DNA001-74-C-0014)
(AD-A014327) Avail: NTIS CSCL 04/1

Summaries of research on atmospheric chemistry and physics are presented. Reaction kinetics, atomic and molecular physical processes, and thermochemistry related to the upper atmosphere are included. GRA

N76-15753# Naval Postgraduate School, Monterey, Calif.
FEASIBILITY OF AN OPERATIONAL TROPICAL CYCLONE PREDICTION MODEL FOR THE WESTERN NORTH PACIFIC AREA Technical Report, Mar. 1974 - Mar. 1975
Russell L. Elsberry 15 May 1975 63 p refs
(ZF61512001)
(AD-A014555; NPS-51ES75051) Avail: NTIS CSCL 04/2

Recent developments in numerical simulation of tropical cyclones and in limited-area, fine-mesh modeling of non-tropical systems are reviewed. Feasibility of developing an operational model for the western North Pacific Ocean region is discussed in terms of a nested grid model. Boundary conditions, numerical techniques, initialization and representation of the physical processes are considered. It is recommended that several Navy agencies cooperate in the development of an operational model to improve meteorological and oceanographic support in the western Pacific region. Author (GRA)

N76-15754*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-SITU WATER VAPOR MEASUREMENTS IN STRATOSPHERIC AIRCRAFT FLIGHTS Final Report
Ernest Hilsenrath and Bruce Guenther May 1975 51 p
Sponsored in part by DOT
(NASA-TM-X-72955; PB-244441/2) Avail: NTIS HC $4.50 CSCL 04B

An aluminum oxide hygrometer was flown on board the Climatic Impact Assessment Program RB-57 aircraft. The instrument was designed to measure ambient water vapor in-situ. It was mounted in the nose of the aircraft and data were recorded by the aircraft flight recorder system. Data from flights from January 1974 to May 1974 were processed and compiled to form a 500 point data base. From this data base, water vapor as a function of time, latitude, longitude, or altitude can be retrieved. The data from the LACATE comparison flights and the rocket plume penetration flights are presented. A pseudo-meridional cross section of water vapor between 40,000 feet and 60,000 feet from 50 degrees N to 50 degrees S latitudes was constructed. The cross section shows water vapor mixing ratios between one and nine micrograms per gram with hemispheric asymmetry of wet and dry regions. The wetter regions appear over the intertropical convergence zone and at mid to high latitudes. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-15755# Coastal Engineering Research Center, Fort Belvoir, Va.
USE OF THE RADIOISOTOPIC SAND TRACER (RIST) SYSTEM
Charles W. Judge Jun. 1975 77 p refs
(Contract AT(49-11)-2988)
(AD-A014168; CERC-TM-53) Avail: NTIS CSCL 13/2

The Coastal Engineering Research Center (CERC), under a multiagency program initiated in 1966, has developed a synoptic sand tracing system capable of operating on the beach, in the surf zone, and offshore. This system has application in determining sediment movement along coastal areas. Some specific problems to which the system can be applied are: (a) mechanisms of sediment movement; (b) improving beach fill criteria; (c) relation of engineering structures to sediment transport; and (d) movement of disposal materials. Sand of the desired size characteristics is plated with gold 198-199 isotopes and sealed in water soluble packets. The packets are injected in the water as either line or point sources by extrusion from the carrier-injection device. Surveying is conducted from an amphibious vehicle (LARC) which tows a ball-like device containing four scintillation detectors. Signals from the detectors are transmitted by cable to the onboard data collection system. The system also collects other data (e.g., navigation, fathometer, etc.) pertinent to surveying; this data is telemetered to a shore-based PDP-8 computer system for field processing. Processed data are plotted on the cathode ray tube (CRT) real-time data display and stored on magnetic tape for further analysis. Data obtained with the RIST system represent nearly synoptic observation of sediment transport within one or all of the nearshore environmental zones over a wide area. GRA

N76-15756# Coastal Zone Resources Corp., Wilmington, N.C.
A STUDY TO ASSESS GOALS FOR USES AND MANAGEMENT OF SHORELINE AND IMPLICATIONS FOR CORPS OF ENGINEERS PROGRAMS Final Report
Jul. 1975 106 p refs
(Contract DACW31-75-C-0017)
(AD-A014157; IWR-CR-75-4) Avail: NTIS CSCL 13/2

A high level of activity relating to use and management of shorelines and the coastal zone is in evidence. The study is an assessment of the significance of legislation, policies and actions affecting the coastal zone at all levels of government. The assessed activities are interpreted for their significance to Corps of Engineer programs in shore protection. The study concludes that the states assert their authority for the coastal zone management function and the Federal agencies should help identify and perform activities complimentary to state programs. Further the Corps is advised to formulize its technical support relationships with state coastal zone agencies, develop and prepare educational materials to assist in coastal zone problems, expand research in coastal problems and explain remote sensing technology. GRA

N76-15757# Woods Hole Oceanographic Institution, Mass.
NOTES ON THE 1974 SUMMER STUDY PROGRAM IN GEOPHYSICAL FLUID DYNAMICS AT THE WOODS HOLE OCEANOGRAPHIC INSTITUTION, VOLUME 1
1974 140 p refs
(Grant NSF GA-37116)
(PB-244611/0; WHOI-74-63-Vol-1) Avail: NTIS HC $6.00 CSCL 08C

This year the central topic was the general circulation of the oceans. Some of the basic ideas used in wind-driven and thermohaline studies were presented in the introductory course of lectures and simple models that have guided the thinking in the development of the topic were discussed. GRA

N76-15758# Woods Hole Oceanographic Institution, Mass.
NOTES ON THE 1974 SUMMER STUDY PROGRAM IN GEOPHYSICAL FLUID DYNAMICS AT THE WOODS HOLE OCEANOGRAPHIC INSTITUTION, VOLUME 2
1974 166 p refs
(Grant NSF GA-37116)
(PB-244612/8; WHOI-74-63-Vol-2) Avail: NTIS HC $6.75 CSCL 08C

Contents: An energy minimization principle for oceanic currents and atmospheric jet streams - theory and experiment; the oscillating cylindrical boundary experiment; forced internal oscillations in Fjords; forced motions in a baroclinic equatorial ocean; the intensification of upwelling equatorward of capes; diffraction of Rossby waves by a wedge-shaped lateral boundary; convectively-driven dynamos; heat source convection; flow of bottom water across the equator; parameterization of heat and momentum flux in the Ekman Layer. GRA

N76-15759# Maryland Univ., College Park. Water Resources Research Center.
FLOOD RUNOFF FROM URBAN AREAS
Richard H. McCuen Jun. 1975 76 p refs
(Grant DI-14-31-0001-5020)
(PB-244504/7; TR-33; W75-10904; OWRT-A-025-MD(2)) Avail: NTIS HC $5.00 CSCL 08C

The study examined several important aspects of urban water resources management and resulted in the following: (1) a set of prediction equations that can be used to estimate different land use characteristics from selected demographic characteristics; (2) a set of design curves relating peak discharge and the land use intensity rating, as a function of the exceedence probability (i.e., return period); (3) a set of design curves showing the effect of rooftop detention on peak discharge for various land use intensity ratings and exceedence probabilities; (4) a computer model of a storm water detention facility and (5) a model study which compared the effect of the individual-site approach to the regional approach to storm water detention. GRA

N76-15760# National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service.
BOMEX PERMANENT ARCHIVE, DESCRIPTION OF DATA
May 1975 336 p refs
(COM-75-11116/1; NOAA-TR-EDS-12; NOAA-75072309) Avail: NTIS HC $10.00 CSCL 08J

Data available from the BOMEX Permanent Archive, a depository for data collected during the Barbados Oceanographic and Meteorological Experiment (BOMEX) in 1969 are described. Procedures used in data processing are described, and an inventory of the archived data is given. GRA

N76-15761# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EFFECT OF SOURCE ORIENTATION AND LOCATION IN THE ALEUTIAN TRENCH ON TSUNAMI AMPLITUDE ALONG THE PACIFIC COAST OF THE CONTINENTAL UNITED STATES Final Report
James R. Houston, Robert W. Whalin, Andrew W. Garcia, and H. Lee Butler Jul. 1975 53 p refs
(AD-A014145; AEWES-RR-H-75-4) Avail: NTIS CSCL 08/11

An investigation was undertaken to ascertain the effect of the orientation and location of elliptically shaped tsunamigenic ground displacements of earthquakes along the Aleutian trench on resulting tsunami amplitude along the Pacific coast of the continental United States. The Aleutian trench was partitioned into 12 segments and a hypothetical ground displacement was centered in each segment. A numerical model was used to propagate the tsunami generated by an uplift to the Pacific coast of the continental United States. An analytical solution of the governing equations of motion was used to propagate the tsunami from the grid points of the numerical grid closest to land to a common water depth of 600 ft so that there would be a standard depth to facilitate comparisons. Contour plots of water-surface wave elevation three hr after generation of the tsunamis readily depict the directional patterns of the waves radiated by the ground displacements. GRA

N76-15762# Delaware Univ., Newark. Coll. of Marine Studies.
INTERPRETATION OF STRUCTURES OVER OCEANIC REGIONS IN DMSP DATA
Karl-Heinz Szekielda May 1975 42 p refs
(Contract N66314-74-C-1294)
(AD-A014320; CMS-C-1-75; EPRF-TR-5-75(UD)) Avail: NTIS CSCL 08/10

Images obtained by the Defense Meteorological Satellite Program (DMSP) over the Gulf of Mexico were interpreted. In differentiating the optical characteristics of various targets, hydrography, and the frequency of occurrence of features, it was concluded that structures recognized in the offshore region were not caused by chlorophyll concentration, current boundaries (temperature gradients), sea state, or sediments. It is suggested that the atmosphere might be the significant cause for the structures recognized over cloud-free regions by the DMSP. This conclusion will be limited strictly to the case studies presented. GRA

N76-15763# Texas A&M Univ., College Station. Dept. of Oceanography.
CONTRIBUTIONS TO THE DYNAMICS OF THE ANTARCTIC CIRCUMPOLAR CURRENT (ACC). 2: INTEGRAL RELATIONSHIPS
Takashi Ichiye Aug. 1975 37 p refs
(Contract N00014-75-C-0537)
(AD-A014506; TAMU-Ref-75-6-T) Avail: NTIS CSCL 08/3

Non-dimensional equations of motion are derived for the A. C. C. of the barotropic mode, including the bottom friction and the horizontal eddy viscosity. Integration of the vorticity equation leads to the zeroth order stream function which is dependent only on depth divided by Coriolis' parameter. Integration of the momentum equation along a streamline yields the relation between the momentum input by wind stress and its dissipation by the bottom friction and by the horizontal eddy viscosity. The relation determines the magnitude of the stream function. It also explains differences in the total transport of the A. C. C. obtained by Kamenkovich (1962) and by Bryan and Cox (1972). GRA

N76-15764# RAND Corp., Santa Monica, Calif.
A THREE-DIMENSIONAL MODEL FOR ESTUARIES AND COASTAL SEAS. VOLUME 2: ASPECTS OF COMPUTATION Completion Report
Jan J. Leendertse and Shiao-Kung Liu Jun. 1975 132 p refs
(Contract DI-14-31-0001-4237)
(PB-244501/3; R-1764-OWRT; W75-10900; OWRT-C-5252(4237)(1)) Avail: NTIS HC $6.00 CSCL 08C

Different computational aspects of the use of a three-dimensional finite difference model of estuaries, bays, and coastal seas are described. With this model, salinity and temperature distributions can be computed, together with the flow field, and then coupled to the flow computation by a complicated equation of state. In the model an approximation for the sub-gridscale effects is introduced by use of mass and momentum exchange coefficients. The vertical exchanges are dependent on the Richardson number. The model is tested in bays and estuaries with widely different characteristics. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-15765*# General Dynamics/Convair, San Diego, Calif.
DEFINITION OF LIFE SCIENCES LABORATORIES FOR SHUTTLE/SPACELAB. VOLUME 1: EXECUTIVE SUMMARY
Dec. 1975 51 p
(Contract NAS8-31368)
(NASA-CR-144121; CASD-NAS-75-054-Vol-1) Avail: NTIS HC $4.50 CSCL 14B

Research requirements and the laboratories needed to support a Life Sciences research program during the shuttle/Spacelab era were investigated. A common operational research equipment inventory was developed to support a comprehensive but flexible Life Sciences program. Candidate laboratories and operational schedules were defined and evaluated in terms of accomodation

with the Spacelab and overall program planning. Results provide a firm foundation for the initiation of a life science program for the shuttle era. Author

N76-15766*# General Dynamics/Convair, San Diego, Calif.
DEFINITION OF LIFE SCIENCES LABORATORIES FOR SHUTTLE/SPACELAB. VOLUME 2: LIFE SCIENCES LABORATORY CONCEPT DEFINITION
Dec. 1975 184 p refs
(Contract NAS8-31368)
(NASA-CR-144122; CASD-NAS-75-054-Vol-2) Avail: NTIS HC $7.50 CSCL 14B
For abstract, see N76-15765.

N76-15767*# General Dynamics/Convair, San Diego, Calif.
DEFINITION OF LIFE SCIENCES LABORATORIES FOR SHUTTLE/SPACELAB. VOLUME 5: LIFE SCIENCES LABORATORY SYSTEM REQUIREMENTS DATA BOOK. BOOK 1: SYSTEM REQUIREMENTS. BOOK 2: APPENDICES
Dec. 1975 216 p
(Contract NAS8-31368)
(NASA-CR-144123; CASD-NAS-75-054-Vol-5-Bk-1; CASD-NAS-75-054-Vol-5-Bk-2) Avail: NTIS HC $7.75 CSCL 14B
The system requirements of three selected Life Science laboratory concepts are defined for the mission phases of prelaunch, launch, on orbit, descent, and post landing. For Vol. 1, see N76-15765. Author

N76-15768*# General Dynamics/Convair, San Diego, Calif.
DEFINITION OF LIFE SCIENCES LABORATORIES FOR SHUTTLE/SPACELAB. VOLUME 5: LIFE SCIENCES LABORATORY SYSTEM REQUIREMENTS DATA BOOK. BOOK 3: PRELIMARY EQUIPMENT ITEM SPECIFICATION CATALOG
Dec. 1975 319 p
(Contract NAS8-31368)
(NASA-CR-144124; CASD-NAS-75-054-Vol-5-Bk-3) Avail: NTIS HC $9.75 CSCL 14B
Working data on the equipment items within the Life Sciences Laboratory Common Equipment Inventory are presented. For Vol. 1, see N76-15765. Author

N76-15769*# Savannah State Coll., Ga.
STUDIES ON THE TOXIC ELEMENTS AND ORGANIC DEGRADATION PRODUCTS IN AQUATIC BODIES AND SEDIMENTS AROUND KENNEDY SPACE CENTER (KSC) HAULOVER CANAL AND MOSQUITO LAGOON Annual Report, Sep. 1974 - Sep. 1975
G. S. Ghuman, M. P. Menon, and C. Obi Emeh Dec. 1975 63 p refs
(Grant NsG-803)
(NASA-CR-146079) Avail: NTIS HC $4.50 CSCL 06C
The work during the first year ending September, 1975, is reported. Indian River, Haulover Canal, Mosquito Lagoon, and other aquatic areas of discharge around Kennedy Space Center (KSC) were studied. The presentation and interpretation of data on water and sediment samples collected from Haulover Canal and Mosquito Lagoon are included. The field and laboratory data are presented and tentative conclusions were drawn in the various aspects of the study. An attempt was made to correlate the physical, chemical, and biological parameters. Author

N76-15770*# Oakwood Coll., Huntsville, Ala.
INVESTIGATIONS OF THE INHIBITORY EFFECTS OF TOCOPHEROL (VITAMIN E) ON FREE RADICAL DETERIORATION OF CELLULAR MEMBRANES Final Technical Report, 1 Jun. 1974 - 31 May 1975
David Richardson 31 May 1975 11 p refs
(Grant NsG-8017)
(NASA-CR-146071) Avail: NTIS HC $3.50 CSCL 06C
The inhibitory effects are investigated of d,1-alpha-tocopherol and d,1-alpha-tocopheryl acetate on the free radical deterioration of cellular membranes. The level of toxicity of d,1-alpha-tocopherol and d,1-alpha-tocopheryl acetate in mice is determined. Author

N76-15771# Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
A COMPUTER PROGRAM PACKAGE FOR AQUATIC ECOLOGISTS
Paul J. Godfrey, Lois White, and Elizabeth Keokosky Apr. 1975 54 p refs Sponsored in part by Rockefeller Foundation
(PB-244508/8; TR-95; W75-10908; OWRT-A-047-NY(2)) Avail: NTIS HC $4.50 CSCL 06C
Several computer programs developed to meet the specialized needs of data common to aquatic ecology are presented. These programs are useful for data reduction and arrangement, and several were designed to produce output for subsequent use in available statistical program packages. The programs are classified into three groups: (1) generalized programs applicable to many forms of limnological data--INTEGRATE, and AVERAGE (2) specialized programs for chemical data--CO2 and D.O. SAT, and PIGMENT RATIO; and (3) specialized programs for biological data--SPECIES, and SUCCESSION. The programs are written in FORTRAN IV, except for SPECIES which is written in PL/1. All were run on an IBM 360 and IBM 370, but conversion to other systems should not be difficult. The programs are described in detail, and an appendix includes program listings and examples of the outputs. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-15772*# Southwest Research Inst., San Antonio, Tex.
BIOMEDICAL APPLICATIONS TEAM TASKS Final Report, Nov. 1974 - Oct. 1975
Charles J. Laenger, Sr., Robert L. Wilbur, H. Herbert Peel, and Sam R. McFarland 31 Oct. 1975 28 p refs
(Contract NAS9-13775; SwRI Proj. 13-3836)
(NASA-CR-147407) Avail: NTIS HC $4.00 CSCL 06B
The status of the biomedical applications team is discussed along with its activity in applications engineering. Various technology requests are summarized. M.J.S.

N76-15773*# Battelle Pacific Northwest Labs., Richland, Wash. Occupational and Environmental Safety Dept.
TOTAL BODY NITROGEN ANALYSIS Final Report, 1 Feb. - 31 Oct. 1975
H. E. Palmer 28 Nov. 1975 17 p refs
(Contract NAS9-14248)
(NASA-CR-144653) Avail: NTIS HC $3.50 CSCL 06P
Studies of two potential in vivo neutron activation methods for determining total and partial body nitrogen in animals and humans are described. A method using the CO-11 in the expired air as a measure of nitrogen content was found to be adequate for small animals such as rats, but inadequate for human measurements due to a slow excretion rate. Studies on the method of measuring the induced N-13 in the body show that with further development, this method should be adequate for measuring muscle mass changes occurring in animals or humans during space flight. Author

N76-15774# Defense Documentation Center, Alexandria, Va.
AEROSPACE MEDICINE Report Bibliography, Oct. 1958 - Dec. 1974
Jul. 1975 295 p refs
(AD-A012900; DDC/BIB-75/12) Avail: NTIS CSCL 06/5
The bibliography contains unclassified-unlimited citations on Aerospace Medicine. It also includes some pertinent information on space biology. Some aspects discussed in this report are weightlessness, acceleration tolerance, hygiene, behavior, diet, life support, stress physiology, circulatory systems and respiratory systems. Four computer-generated indexes are provided. GRA

N76-15775# Naval Medical Research and Development Command, Bethesda, Md. Electromagnetic Radiation Project Office.
COMPILATION OF NAVY SPONSORED ELF BIOMEDICAL AND ECOLOGICAL RESEARCH REPORTS, VOLUME 1
Feb. 1975 747 p refs

(AD-A015068; EMPRO-2-Vol-1) Avail: NTIS CSCL 06/18

This volume is one of several, which combined in a compilation of all research reports and papers to date, describe the extremely low frequency (ELF) research performed under the Sanguine Biological-Ecological Research Program. It includes all final reports, technical reports, and papers written by the investigators who performed the research. Each document appearing in these volumes was printed from an unedited copy of the investigator's report or from an unedited copy of a paper written by the investigator. No attempt was made to summarize the investigator's results. GRA

N76-15776# Naval Medical Research and Development Command, Bethesda, Md. Electromagnetic Radiation Project Office.

COMPILATION OF NAVY SPONSORED ELF BIOMEDICAL AND ECOLOGICAL RESEARCH REPORTS, VOLUME 2

Feb. 1975 736 p refs

(AD-A015069; EMPRO-2-Vol-2) Avail: NTIS CSCL 06/18

For abstract, see N76-15775.

N76-15777# National Academy of Sciences - National Research Council, Washington, D.C.

COMPENSATION FORMULA FOR HEARING LOSS

W. Dixon Ward Mar. 1975 11 p refs

(Contract N00014-75-C-0406)

(AD-A014487) Avail: NTIS CSCL 06/10

The Committee on Hearing, Bioacoustics and Biomechanics (CHABA) was asked by the Bureau of medicine and Surgery of the Department of the Navy to draft this report which would provide a formula for converting the pure-tone audiometric thresholds of federal employees into percentages of binaural hearing impairment. Under the restriction that the dollar compensation for the new formula using audiometric frequencies measured at 1,000, 2,000 and 3,000 Hz would be approximately the same for each employee as those computed using the previous formula developed by the American Academy of Opthalmology and Otolaryngology (AA) which had used the audiometric frequencies of 500, 1,000 and 2,000 Hz, CHABA was not asked to evaluate the dollar importance of hearing loss, per se. Nor was it asked to evaluate the importance of hearing loss relative to other disabilities, sensory and physical, for which federal employees are compensated. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-15778*# Computer Sciences Corp., Wallops Island, Va. Field Services Div.

AIRCRAFT COCKPIT VISION: MATH MODEL

J. Bashir Jul. 1975 37 p ref

(Contract NAS6-2369)

(NASA-CR-141406) Avail: NTIS HC $4.00 CSCL 05E

A mathematical model was developed to describe the field of vision of a pilot seated in an aircraft. Given the position and orientation of the aircraft, along with the geometrical configuration of its windows, and the location of an object, the model determines whether the object would be within the pilot's external vision envelope provided by the aircraft's windows. The computer program using this model was implemented and is described. Author

N76-15779*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REVIEW OF SUBJECTIVE MEASURES OF HUMAN RESPONSE TO AIRCRAFT NOISE

Jimmy M. Cawthorn and William H. Mayes Jan. 1976 28 p refs Presented at the 3rd Interagency Symp. on Univ. Res. in Transportation Noise, 12-14 Nov. 1975

(NASA-TM-X-72807; Rept-2630) Avail: NTIS HC $4.00 CSCL 20A

The development of aircraft noise rating scales and indexes is reviewed up to the present time. Single event scales, multiple event indexes, and their interrelation with each other, are considered. Research requirements for further refinement and development of aircraft noise rating quantification factors are discussed. Author

N76-15780# Control Data Corp., St. Paul, Minn. Advanced Systems Div.

RESULTS OF THE VISUAL DETECTION SIMULATION EXPERIMENT FOR THE EVALUATION OF AIRCRAFT PILOT WARNING INSTRUMENTS (APWI) Final Report

W. Graham and V. Mangulis Dec. 1974 231 p refs

(Contract DOT-FA70WA-2263)

(AD-A017023/3) Avail: NTIS HC $8.00 CSCL 01/2

Results of an experiment to evaluate Aircraft Pilot Warning Instruments (APWI) in a Visual Detection Simulator (VDS) were reported. A high correlation between observations in the simulator and the real world was demonstrated. APWI systems with sharp range and altitude cut-offs were simulated, with bearing resolutions of 180 deg, 30 deg, and 2 deg; part of the experiment was run with no APWI at all for comparison. The results show that the most critical factor in determining the probability of detection of a target is the time available to the pilot for detection; if the time is long enough the pilot will eventually see it, and if the time is too short even the best of APWI will not help him. There was significant variation found among all pilots in their ability to detect targets and extreme differences were found between the best and worst pilots in this respect. Author

N76-15781*# George Washington Univ., Washington, D.C.

PASSENGER COMFORT DURING TERMINAL-AREA FLIGHT MANEUVERS M.S. Thesis.

Ward Elliott Schoonover, Jr. Jan. 1976 124 p refs Sponsored by NASA

(NASA-CR-146077) Avail: NTIS HC $5.50 CSCL 05E

A series of flight experiments was conducted to obtain passenger subjective responses to closely controlled and repeatable flight maneuvers. In 8 test flights, reactions were obtained from 30 passenger subjects to a wide range of terminal-area maneuvers, including descents, turns, decelerations, and combinations thereof. Analysis of the passenger rating variance indicated that the objective of a repeatable flight passenger environment was achieved. Multiple linear regression models developed from the test data were used to define maneuver motion boundaries for specified degrees of passenger acceptance. Author

N76-15782# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

QUESTIONNAIRE THEORY: MODELLING OF THE PILOT'S MENTAL LOAD

Dominique Soulatges 1974 33 p refs In FRENCH; ENGLISH summary

(ONERA-NT-230) Avail: NTIS HC $4.00

The task carried out by a human operator is modelled, in the form of a robot (in the sense of heuristic programming), and the concept of operator's work load is associated to that of information processed by the robot who takes decisions. The interest of the questionnaire theory is to formalize the concept of information processed on a support of graphs similar to the arborescences deployed by a robot. The main definition of this theory is presented, preceded by a brief survey of information and graph theory concepts necessary to understand them. The connection between heuristic programming and the manner in which the questionnaire theory permits the formalization of the informative cost of decision is also established. A table of base-2 logarithms of integers up to 100 will make it easier to verify the calculation given as examples. Author (ESA)

N76-15783# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

DEVELOPMENT AND TESTS OF HELIOX DIVES IN EXCESS OF 100 m, PART 1

Pierre Cabarrou, Uwe Finkeldey, Hans-Dietrich Fust, Horst Krekeler, Karl-Gerhard Mueller, and Heinz Oser 11 Jul. 1975 46 p refs

(DLR-FB-75-48-Pt-1) Avail: NTIS HC $4.00; DFVLR, Cologne DM 19.20

Possibilities to reduce the necessary decompression time for Heliox dives in the range from 100 to 200 m were investigated. The type m-profile with a medium pressure reduction and a long decompression time, and the type f-profile with a fast pressure reduction and a short decompression time were considered. Except for the initial decompression phase the delta P-values of the f-profile are smaller than those of the m-profile. An analysis of available diving information leads to new type f-profiles 110/60, 135/60, and 150 m/30 min. Heliox-dives were proposed and tested in a dry chamber and a wet pot. During the test of unsuccessful profiles, which had to be rejected, only slight decompression type I sickness symptoms occurred; neither vestibular nor central nervous symptons were noticed. A series of profiles for 135/60/428 and 150 m/30 min/300 min dives, each slightly modified was successful. They may provide a new basis for the introduction of type f-standard tables.
Author (ESA)

N76-15784# Systems Research Labs., Inc., Dayton, Ohio.
DEVELOPMENT, APPLICATION, AND EVALUATION OF A PROCEDURE FOR QUANTIFICATION OF TECHNOLOGICAL CHANGE IMPACT ON HUMAN RESOURCES Final Report, 3 Dec. 1973 - 15 Apr. 1975
Norman R. Potter, Kenneth D. Korkan, and Duncan L. Dieterly Jun. 1975 48 p refs
(Contract F33615-74-C-4019; AF Proj. 7907)
(AD-A014332; AFHRL-TR-75-29(1)) Avail: NTIS CSCL 05/5

A multiphased study was conducted to lead to the development of methods for determining the components and measuring the effects of advances in technology on human resources in Air Force weapon systems. The first phase of the study was reported in AD-A000 051. The second phase involved the development of Design Option Decision Trees (DODT) for two areas of Air Force systems technology: Digital Avionics Information System (DAIS) and Remotely Piloted Vehicle Systems (RPV). The third phase called for the development of unique methods or synthesis of existing techniques to result in a new method for measuring the effects of technology on Air Force human resources. A method integrating the DODT with a modification of the method of summated ratings was developed to arrive at a quantification of human resource effects of technological innovations. This procedure was applied (AD-A014335) to the DODT to provide the source data for the evaluation of the developed method. The DODTs for DAIS are presented in AD-A014333. GRA

N76-15785# Systems Research Labs., Inc., Dayton, Ohio.
DIGITAL AVIONICS INFORMATION SYSTEM DESIGN OPTION DECISION TREES Interim Report, 3 Dec. 1973 - 15 Apr. 1975
Norman R. Potter, Kenneth D. Korkan, and Duncan L. Dieterly Jun. 1975 49 p refs
(Contract F33615-74-C-4019; AF Proj. 7907)
(AD-A014333; AFHRL-TR-75-29(2)) Avail: NTIS CSCL 05/5

The DODTs for a DAIS system were developed to determine the decision points in a design process which may be of importance in projecting the input of new technology on human resource parameters. The DODTs for the DAIS system were refined through the process of extensive reevaluation by experts in the field both in industry and the Air Force. They were then used in another phase of the study to actually determine the design choice impact on selected human resource parameters. The DODT technique allows for a rather extensive evaluation of the design choices for the completion of a total system. In addition to the major purpose of the DODTs for this research project, as a tool for assisting in quantifying human resource requirements of various technologies, they may be used for a series of other management actions. GRA

N76-15786# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
PERCEPTION AND ATTENTION
Howard E. Egeth 15 Aug. 1975 18 p refs Submitted for publication
(Contract N00014-67-A-0163-0012; NR Proj. 197-017)
(AD-A014215; TR-81) Avail: NTIS CSCL 05/10

The paper provides the reader with an up-to-date account of the empirical and theoretical status of the concept of attention. The emphasis in this review is on the properties of attention that are manifested in studies of human perceptual processes.
GRA

N76-15787# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
INFLUENCE OF VARIOUS ACCELERATION ENVIRONMENTS ON THE ABILITY TO ACTIVATE CONTROLS FOR EMERGENCY DEVICES
Emma Fessenden 17 Jul. 1975 25 p refs
(WF41451402)
(AD-A014545; NADC-75079-40) Avail: NTIS CSCL 06/7

A series of experiments were performed which used the performance ability of aircrewmen in activating emergency devices to develop test and evaluation methods for emergency control devices under acceleration environments. Environments of realistic emergency situations were dynamically simulated in the human centrifuge. The interaction between various devices and their location with the environment was analyzed. Anthropometric correlation with failure to activate the emergency control device is given. The method of analyses is described and results of the experiments are presented. Author (GRA)

N76-15788# Catholic Univ. of America, Washington, D.C. Human Performance Lab.
STRUCTURAL COMPONENTS IN THE PERCEPTION OF SIXTEEN COMPLEX SOUNDS
James H. Howard, Jr. and Eugene B. Silverman 1 Aug. 1975 45 p refs
(Contract N00014-75-C-0308; NR Proj. 197-027)
(AD-A014133; TR-75-1-ONR) Avail: NTIS CSCL 05/10

The INDSCAL multidimensional scaling model was used to investigate the distinctive features involved in the perception of sixteen complex non-speech sounds. The signals differed along four physical dimensions: fundamental frequency, waveform, formant frequency and number of formants. Scaling results indicated that subjects' similarity ratings could be accounted for by three psychological or perceptual dimensions. A statistically reliable correspondence was observed between these perceptual dimensions and the physical characteristics fundamental frequency, waveform, and a combination of the two formant parameters. These results were further explored with Johnson's (1967) hierarchical clustering analysis. Large differences in featural saliency occurred in the group data with fundamental accounting for more variability than the remaining dimensions. Further analysis of individual subject data revealed large individual differences in featural saliency. These differences were related to past musical experience of the subject and to earlier findings using similar signals. It was concluded that (1) the INDSCAL model provides a useful model for the analysis of auditory perception in the non-speech mode, (2) featural saliency in such sounds is likely to be determined by an unspecified attentional mechanism. The implications of these findings for tactical sonar operations was discussed. Author (GRA)

N76-15789# Human Resources Research Organization, Alexandria, Va.
MULTIVARIATE EXTRAPOCATION OF TRAINING PERFORMANCE
James W. Dees and L. Paul Dufilho Jun. 1975 149 p refs
(Contract DAHC19-73-C-0004)
(AD-A014172; HumRRO-TR-75-16) Avail: NTIS CSCL 05/9

The report summarizes the techniques used in gathering and maintaining a data file on most of the Army aviator trainees who have been through the Officer/Warrant Officer Rotary Wing Aviator Course 2C-1981-B/2C-062B-B and the Warrant Officer Candidate Course 2C-062B-C during the period 1 July 1968-31 December 1969. Specific regression analyses dealing with the prediction of student performance in training are furnished, and the methods used to obtain them are described. The equations allow the extrapolation of current training performance to a prediction of (a) the probability that the individual will pass the course, and (b) what his final end-of-course grade will be. A review of the most pertinent literature in the area is included as are frequency counts of a large volume of training data. GRA

N76-15790# Quest Research Corp., McLean, Va.
COMPUTER-AIDED TECHNIQUES FOR PROVIDING

OPERATOR PERFORMANCE MEASURES Final Report, Jul. 1972 - Aug. 1974
Edward M. Connelly, Francis J. Bourne, Diane G. Loental, and Patricia A. Knoop Dec. 1974 85 p refs
(Contract F33615-72-C-2094; AF Proj. 6114)
(AD-A014330; AFHRL-TR-74-87) Avail: NTIS CSCL 05/9

This report documents the theory, structure, and implementation of a performance measurement processor (written in FORTRAN IV) that can accept performance demonstration data representing various levels of operator's skill and, under user control, analyze data to provide candidate performance measures and validation test results. The processor accepts two types of information: (1) Sample performance data on magnetic tape, and (2) User information reflecting knowledge about features of the performance that are considered to be important to measurement. The sample performance data input is smoothed by the processor in order to remove or reduce noise factors in accordance with information provided by the user. Criterion performance functions are, optionally, provided by the user or are computed by the processor using skilled performers' data. The processor then develops a discrete representation of the continuous performance data based on observed deviations from the criterion functions. Candidate performance measures are generated by operating on the vectors with multiple regression algorithms. Empirical validation tests of several types are applied to the candidate measures for assessment of their validity-likelihood. The processor can be applied to measurement problems where the human operator working with his equipment obtains demonstrations of various levels of performance. These potential applications include those situations where criterion performance cannot be quantitatively predefined and/or the existing definitions are ambiguous. GRA

N76-15791# Quest Research Corp., McLean, Va.
CANDIDATE T-37 PILOT PERFORMANCE MEASURES FOR FIVE CONTACT MANEUVERS Final Report, Jul. 1972 - Aug. 1974
Edward M. Connelly, Francis J. Bourne, Diane G. Loental, Joseph S. Migliaccio, and Duane A. Burchick Dec. 1974 87 p refs
(Contract F33615-72-C-2028; AF Proj. 6114)
(AD-A014331; AFHRL-TR-74-88) Avail: NTIS CSCL 05/9

The objective of this program was to develop candidate pilot performance measures for five undergraduate pilot training (UPT) contact training maneuvers flown in the T-37B aircraft. The work included development and application of a method of analyzing operator performance tasks for purposes of identifying candidate measures. This resulted in sectoring of each T-37B maneuver into functional segments, wherein the dominant measurement variables are consistent, and task segments, wherein the relationships among the dominant measurement variables are consistent. Several types of measures were then defined which, collectively, satisfy measurement needs over all task segments. Specific candidate measurement formulae were developed for each segment in accordance with the analysis results. Computer programs (FORTRAN IV) were developed and implemented to: (1) Smooth, print out, and plot data recorded on-board a T-37B aircraft; (2) Automatically detect task segment boundaries; (3) Compute criterion functions from skilled performer's data; (4) Compute measures specified at run-time by the user, and (5) perform and print results of several empirical validation tests of the candidate measures for subsequent researcher analysis. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-15792*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HIGH VISIBILITY AIR SEA RESCUE PANEL Patent Application
Jack Naimer and Mathew I. Radnofsky, inventors (to NASA) Filed 17 Dec. 1975 10 p
(NASA-Case-MSC-12564-1; US-Patent-Appl-SN-641862) Avail: NTIS HC $3.50 CSCL 05H

A system for air sea rescue utilizing a thin film, large area, easily deployable, highly visible, buoyant panel which is formed of a substrate having a specific gravity less than sea water and impregnated with a brilliant fluorescent pigment is described. The panel may be accordion folded for compactness and ease of deployment, may have an inflatable periphery to enhance deployment, rigidity, and buoyancy and may include means for attachment to a flotation device. NASA

N76-15793# Unilever Research, Vlaardingen (Netherlands).
THE FILTRAGOMETER: A NEW DEVICE FOR MEASURING PLATELET AGGREGATION IN VENOUS BLOOD OF MAN
G. Hornstra and F. TenHoor [1974] 40 p refs Revised
Submitted for publication
Avail: NTIS HC $4.00

A device for the direct assessment of spontaneous platelet aggregation in human venous blood is described. The principle of the method is based on measurement of the pressure difference across a filter with pores of 20 micron diameter through which blood from a forearm vein is drawn. Platelet aggregates, obstructing the filter, cause a change in the pressure difference which is proportional to the degree of platelet aggregation. Platelet aggregation as measured with the filtragometer depends on the type of anticoagulant used. The filtragometer response decreases on inhibition of platelet stickiness in vitro by prostaglandin E and in vivo by aspirin ingestion. Moreover it appeared to be higher in a group with a high thrombosis tendency than in a group less susceptible to fatal arterial thrombosis. The filtragometer seems especially useful in monitoring the results of diet and/or drug therapy. Author (ESA)

N76-15794# Naval Research Lab., Washington, D.C.
EVALUATION OF MATERIALS FOR MANNED VESSELS TO ASSURE HABITABLE ATMOSPHERES Final Report
Frederick W. Williams and Homer W. Carhart Aug. 1975 18 p refs
(AD-A014410; NRL-MR-3091) Avail: NTIS CSCL 13/10

Materials used for construction, upkeep, and routine operations of submersibles, undersea chambers, and diving complexes must be considered in view of their potential to pollute the atmosphere. Two preliminary tests, Flammability and Outgas, are used to initially screen materials. More extensive testing of materials is accomplished with a thermal gravimetric apparatus used in conjunction with gas chromatography and mass spectrometry to measure the chemicals given off by a material under thermal stress from 70 to 400C. GRA

N76-15795# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
REVIEW OF THE OPERATIONAL EFFICACY OF USAF FLIGHT HELMETS IN CRASH AND ESCAPE ENVIRONMENTS
James W. Brinkley Aug. 1975 15 p refs
(AF Proj. 7231)
(AD-A014263; AMRL-TR-75-74) Avail: NTIS CSCL 06/17

A review of available statistics from aircraft ejections and crashes was conducted to evaluate the efficacy of USAF flight helmets. The review was presented to the fifteenth meeting of Working Party 61 of the Air Standardization Coordinating Committee held in Auckland, New Zealand. The report concentrates on the analysis of data obtained from reports of accidents that occurred during the period of 1 January 1968 to 31 December 1972. Helmet loss rates are compared to the type of helmet, helmet suspension system, use of visor, use of chin or nape strap, airspeed, and aircraft type. Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N76-15796*# Intermetrics, Inc., Cambridge, Mass.
ON THE PERFORMANCE OF THE HAL/S-FC COMPILER
Fred H. Martin 22 Oct. 1975 80 p refs
(Contract NAS9-13864)
(NASA-CR-144652; IR-162) Avail: NTIS HC $5.00 CSCL 09B

The HAL/S compilers which will be used in the space shuttles are described. Acceptance test objectives and procedures are described, the raw results are presented and analyzed, and conclusions and observations are drawn. An appendix is included containing an illustrative set of compiler listings and results for one of the test cases. Author

N76-15797# Illinois Univ., Urbana. Center for Advanced Computation.
AN ANNOTATED BIBLIOGRAPHY TO NETWORK DATA MANAGEMENT AND RELATED LITERATURE Interim Report
Peter A. Alsberg, Geneva G. Belford, Deborah S. Brown, Steve R. Bunch, and John D. Day 1 Apr. 1975 283 p refs
(Contract DCA100-75-C-0021)
(AD-A014232; UIUC-CAC-DN-75-149) Avail: NTIS CSCL 09/2

Over 400 documents related to network data management and resource sharing are annotated. The documents cover topics in data management, computer networks, operating system concepts, communications, resource allocation, measurement and analysis, front ends, security and application support. GRA

N76-15798# Illinois Univ., Urbana. Center for Advanced Computation.
A STATE-OF-THE-ART REPORT ON NETWORK DATA MANAGEMENT AND RELATED TECHNOLOGY Interim Report
Geneva G. Belford, Steve R. Bunch, John D. Day, Peter A. Alsberg, and Deborah S. Brown 1 Apr. 1975 159 p refs
(Contract DCA100-75-C-0021)
(AD-A014233; UIUC-CAC-DN-75-150) Avail: NTIS CSCL 09/2

The state-of-the-art is described in 16 areas related to data management and resource sharing on computer networks. The data management topics covered include data organization (structures and access techniques), optimization (hashing, clustering, partitioning, and compression), data languages (for structure definition and query), and file allocation on a network. The topics covered relating to the network and systems environment include communications, resource allocation, measurement and evaluation, network front ends, and security. The topics relating to network applications discuss general user support, and network management. GRA

N76-15799# National Bureau of Standards, Washington, D.C. Systems and Software Div.
A BASIS FOR STANDARDIZATION OF USER-TERMINAL PROTOCOLS FOR COMPUTER NETWORK ACCESS
A. J. Neumann Jul. 1975 32 p refs
(Grant NSF CA-68)
(COM-75-11124/5; NBS-TN-877; LC-75-600052) Avail: NTIS HC $4.00 CSCL 09B

A user-terminal protocol is defined which enables a user at a terminal to access computered information systems. The basic functions such as identification, authorization, and validation are outlined and various signals and messages making up the protocol are identified. The purpose of the paper is to establish a basis for standardization and development of a unified user protocol. GRA

N76-15800# Naval Civil Engineering Lab., Port Hueneme, Calif.
TRANSIENT SUSCEPTIBILITY TEST OF AN/GYK-3(V) DIGITAL DATA PROCESSING SYSTEM AT SKAGGS ISLAND Final Technical Note, Jun. - Dec. 1974
M. N. Smith Aug. 1975 36 p refs
(AD-A014200; CEL-TN-1397) Avail: NTIS CSCL 09/2

Susceptibility tests were made on an AN/GYK-3(V) Digital Data Processing System at the Naval Security Group Headquarters at Skaggs Island, California, using Power Transient Synthesizer and Power Transient Monitor developed by the Civil Engineering Laboratory. These tests were to determine the quality of electrical power required by the system to operate with a minimum of failures. Eight components of the system were tested individually, and then the system as a whole was tested. Results are discussed in the report. GRA

N76-15801# Massachusetts Inst. of Tech., Cambridge.
PERFORMANCE ANALYSIS OF A DATA-FLOW PROCESSOR
David P. Misunas Aug. 1975 9 p refs
(Contract N00014-75-C-0661; Proj. MAC)
(AD-A014567; MAC-CSG-M-128) Avail: NTIS CSCL 09/2

A data-flow processor is structured as a packet communication system. Sections of a processor are connected by interconnection networks which have a great deal of inherent parallelism, and the sections communicate by means of fixed size information packets. The processing capability of a data-flow processor is determined through consideration of the flow of packets within the interconnection networks, and the actual performance of the processor is affected by the structure of the networks. The execution time of an instruction in a processor can vary greatly due to conflict within the interconnection networks. The performance of a data-flow processor is measured through consideration of the delays caused by this conflict, and the proper network structure and processing rate of a machine are determined through analysis of the best and worst case delays. GRA

N76-15802# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
EXPLORATORY DEVELOPMENT OF MAGNETIC BUBBLE DOMAIN MATERIAL FOR APPLICATION IN AIR FORCE SOLID STATE MASS MEMORY SYSTEMS Final Report, 27 Nov. 1972 - 30 Nov. 1974
D. M. Heinz, M. T. Elliott, R. D. Henry, and F. S. Stearns Mar. 1975 98 p refs
(Contract F33615-73-C-5017; AF Proj. 7371)
(AD-A014364; C73-4.25/501; AFML-TR-75-12) Avail: NTIS CSCL 09/2

The objectives of this program were to develop bubble domain materials which perform in a military environment and meet device goals of a bit density of 1M bit/sq. in., a data rate of 1 MHz and an operating temperature range of -25 to 75C. All of these program objectives have substantially been met. The military environment was considered to consist of extremes of temperature, dynamic mechanical stress and radiation. Bubble device operation over the temperature range of -25 to 75C was addressed in the design of garnet compositions. The effects of shock and vibration were explored on bubble domain garnet films, and results were obtained that revealed the absence of potentially deleterious magnetomechanical effects. Radiation studies on a related program which was coordinated with this one show the bubble garnets to be very tolerant of nuclear radiation. Thus bubble domain garnet materials should perform satisfactorily in such an environment. GRA

N76-15803# Inco, Inc., McLean, Va.
TOSS EXCHANGE CENTER Final Technical Report

Richard Taylor, Del Lewis, Stanley Adams, Richard Hicks, and Robert Montcalm Griffiss AFB, N. Y. RADC Jun. 1975 110 p
(Contract F30602-73-C-0347; AF Proj. 4594)
(AD-A014350; TR-TEC-1014-1; RADC-TR-75-162) Avail: NTIS CSCL 15/4

This final Technical Report documents the TOSS Exchange Center (TEC). TEC is the communications utility subsystem of the Terminal Oriented Support System (TOSS). TEC was designed to provide all the facilities needed to handle the transfer of data between intelligence centers. This utility is provided to assist the analyst to exploit and disseminate crises and event oriented intelligence information that is time critical, with specific emphasis on satisfying the analysts' requirement of timeliness, reliability, and flexibility. Author (GRA)

N76-15212* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A RELATIONAL DATA BASE IMPLEMENTED USING MBASIC
R. M. Smith *In its* The Deep Space Network 15 Dec. 1975 p 291-305 refs (For availability see N76-15190 06-12)
CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-15804 Missouri Univ., Columbia.
COMPUTER AIDED GENERATION OF STABILITY REGIONS Ph.D. Thesis
Raman Menon Unnikrishnan 1975 230 p
Avail: Univ. Microfilms Order No. 75-1056

A study was conducted to develop techniques by which complex analytical methods can be successfully adapted for the analysis of practical dynamic systems. The major contributions of the study include: (1) effective algorithms for the stability analysis of higher order nonlinear systems, (2) application of nonlinear programming techniques for optimization of stability regions, (3) efficient analysis of nonlinear time varying systems and development of a scheme for parameter optimization, and (4) development of packages for stability analysis of practical systems aimed at a user with minimal theoretical background. Dissert. Abstr.

N76-15805# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
REALIZATION OF THE SET OF DECOUPLING INVARIANTS
A. Clonso-Concheiro and H. H. Johnson Jun. 1974 6 p refs Sponsored in part by Banco de Mex., Natl. Univ. of Mex. and Brit. Council
(Publ-74/50) Avail: NTIS HC $3.50

An algorithm for finding a realization of an arbitrary set of decoupling invariants is given. The realization obtained has the minimum possible order among all the realizations of the given set of invariants. Author (ESA)

N76-15806# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
A STACK MACHINE EMULATOR Final Report, Aug. 1973 - Mar. 1974
Christine M. Anderson Jun. 1975 353 p refs
(AF Proj. 2003)
(AD-A014253; AFAL-TR-74-180) Avail: NTIS CSCL 09/12

An emulator of a stack machine, very similar to the Burroughs 6700, is described. The emulator is coded in TRANSLANG (i.e., Burroughs microlanguage) and runs on AFAL's Aerospace Multiprocessor. The emulator is intended to support an extended ALGOL compiler, Burroughs 6700 operating system, and the TRANSLANG assembler. Author (GRA)

N76-15807# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
A FORTRAN PROGRAM FOR THE CALCULATION OF THE STATE TRANSITION MATRIX AS A LINEAR COMBINATION OF REAL TIME FUNCTIONS (EAT)
Lewis G. Minor and John R. Underwood 16 May 1975 47 p refs
(DA Proj. 1M3-62303-A-214)
(AD-A014197; RE-75-32) Avail: NTIS CSCL 09/2

Many programs are available which calculate numerically the state transition matrix at a specific time. However, programs which give the solution as a linear combination of real time functions are not generally available. The program given in this report calculates the state transition matrix as a linear combination of real time functions starting from any real system matrix. Author (GRA)

N76-15808# Cornell Univ., Ithaca, N.Y. Dept. of Computer Science.
THE COMPLEXITY OF RESOLUTION PROCEDURES FOR THEOREM PROVING IN THE PROPOSITIONAL CALCULUS Ph.D. Thesis
Zvi Galil May 1975 122 p refs
(Contract N00014-67-A-0077-0021)
(AD-A014220; CU-CSD-75-239) Avail: NTIS CSCL 09/2

A comparative study on the complexity of various procedures for proving that a set of clauses is contradictory, is described. All the procedures either use the resolution rule in some form or are closely related to procedures which do. Among the procedures considered are resolution, regular resolution, Davis Putnam procedure, resolution with extension, bounded (and iterated bounded) resolution, enumeration procedures, and semantic trees. The results include exponential lower bounds for the run-time of most of the procedures, relations between the various procedures, and implications to the complexity of integer programming routines. GRA

N76-15809# Massachusetts Inst. of Tech., Cambridge.
STRUCTURE PROCESSING IN A DATA-FLOW COMPUTER
David P. Misunas Aug. 1975 8 p refs
(Contract N00014-75-C-0661; Proj. MAC)
(AD-A014566; MAC-CSG-M-129) Avail: NTIS CSCL 09/2

A data-flow computer uses a packet communication system to achieve highly parallel execution of programs expressed in data-flow form. The machine is composed of two sections which perform instruction processing and structure processing and share a common auxiliary memory. The structure processing section of the processor maintains data structures represented as acyclic directed graphs and is viewed as a functional unit by the instruction processing section; that is, instructions specifying structure operations are sent to the section, and the resulting values are returned to the instruction processing section. The organization of the structure processing section as a packet communication system permits the simultaneous processing of many structure operations, while avoiding the deadlock and synchronization problems often associated with systems that support concurrent memory transactions. GRA

N76-15810# Naval Postgraduate School, Monterey, Calif.
STRUCTURE AND ERROR DETECTION IN COMPUTER SOFTWARE
Gordon H. Bradley, Thomas Green, Gilbert T. Howard, and Norman F. Schneidewind Feb. 1975 23 p refs
(AD-A014334; NPS-55Ss75021) Avail: NTIS CSCL 09/2

A model of the error detection process for the testing of software has been developed to investigate the relationship of computer program structure to error detection and test effort. The model has been implemented as a simulation. Analytical results have also been obtained. Author (GRA)

N76-15811# Cincinnati Univ., Ohio.
SOME GENERAL PROGRAMS FOR DESK TOP COMPUTERS Summary Report, Jul. 1973 - Sep. 1974
John S. Wagner May 1975 37 p refs
(Contract F33615-73-C-5084; AF Proj. 7351)
(AD-A014352; AFML-TR-74-276) Avail: NTIS CSCL 09/2

A library of four data analysis programs for the H-P 9820A are presented with operational procedures and complete listings. The library includes a general least squares curve fitting program for polynomials up to degree six with automatic plotting of both

the data, fitted curve, and coefficients. In addition a data and function plot program is included which enables efficient plotting of analytic functions and data with control of axis location, labels, and data symbols. Thirdly, a linear regression program is developed which includes a complete statistical analysis of the fitted line. Finally, a general digitizing program is listed which enables quick conversion of graphical information into tabular data without special orientation of the digitizing surface. Author (GRA)

N76-15812# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
AN INTERACTIVE COMPUTER GRAPHICS TERMINAL SYSTEM INTRODUCTION/APPLICATION
Larmon S. Isom 2 Jun. 1975 40 p refs
(DA Proj. 1M3-63310-D-074)
(AD-A014152; RG-75-54) Avail: NTIS CSCL 09/2

An interactive computer graphics terminal system generally consists of both hardware and software, the software being used to drive and control the functioning of the hardware. The software is composed of a user's application program and a library of program routines. The hardware, an application program, and the library of program routines for a particular interactive computer graphics terminal system configuration are described in this report. GRA

N76-15813# College of William and Mary, Williamsburg, Va. Dept. of Mathematics.
SWAT/WM, A STRUCTURED DIALECT OF WATFIV
Norman E. Gibbs and Andrew L. Hisgen Aug. 1975 33 p refs
(Contract N00014-73-A-0374-0001; NR Proj. 044-459)
(AD-A014437; TR-10) Avail: NTIS CSCL 09/2

Many installations have had to use FORTRAN extensively in their work because of various economic, political, and social pressures. This paper describes a dialect of WATFIV, called SWAT/WM, which was developed to facilitate the teaching of structured programming concepts in the introductory programming course at the College of William and Mary. The control structures which are described could be implemented in other FORTRAN compilers. GRA

N76-15814# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNICAL CUSTOMER SERVICE FOR THE EDP SYSTEM ROBOTRON 21 AND THE EQUIPMENT TECHNOLOGY OF THE ESER
C. Markert 24 Jul. 1975 51 p Transl. into ENGLISH from Rechentechnik, Datenverarbeitung (East Germany), v. 10, no. 11, Nov. 1973 p 31-43
(AD-A014525; FTD-ID(RS)I-1487-75) Avail: NTIS CSCL 09/2

Far more extensively than the R 300, the Robotron 21 system of the ESER offers the possibility of carrying out maintenance tasks and tests without burdening the central processor. This potential, however, places strong emphasis on precise coordination between this work and the running of user programs. Appropriate program-dependent coordination of the maintenance and test activities can achieve an average down time for the entire installation of not more than 3 to 5 percent of the productive running time, depending of course on the particular configuration. That is, the greater portion of this kind of work can be accomplished without interfering with the normal computing tasks. This advantage results primarily from the use of maintenance-free components and preventive maintenance in the form of periodic tests during installation. With the aid of test programs in the disk-based operating system, the operation of the following peripherals can be tested selectively by the operator or the technician: Console Unit; Punched Paper Tape Unit; Punched Card Reader; Card Punch; Magnetic Tape Deck; Changeable Disk Unit; Line Printer. GRA

N76-15815# Ohio State Univ., Columbus. Computer and Information Science Research Center.
PREST4: A HIGHLY STRUCTURED FORTRAN LANGUAGE FOR SYSTEMS PROGRAMMING
Neal Kaffen and Thomas Rodeheffer Jul. 1975 45 p refs
(Contract N00014-75-C-0573)
(AD-A014615; OSU-CISRC-TR-75-4) Avail: NTIS CSCL 09/2

PREST4 is a program on the DECSystem-10 that takes an input file containing source code written in the PREST4 language, and generates an output file in standard DEC FORTRAN. As an option, it also generates a listing. Basically, the PREST4 language is an extension of FORTRAN with changes made to facilitate the writing of structured programs. Thus the name PREST4, PREprocessor for STructured FOR(4)TRAN, is coined. GRA

N76-15816# Ohio State Univ., Columbus. Computer and Information Science Research Center.
DATA BASE MODULE VERIFICATION: A CERTIFICATION METHOD FOR DATA SECURE SYSTEMS
William A. Horger, Jr. Jun. 1975 135 p refs
(Contract N00014-75-C-0573)
(AD-A014614; OSU-CISRC-TR-75-3) Avail: NTIS CSCL 09/2

The verification technique used is the inductive assertion method. The verification is discussed of programs operating on a complex data structure called the generalized file organization. As part of this investigation, additional complex data structures are introduced which will be manipulated by the programs. If these manipulations are properly performed, the correctness of the programs is guaranteed. These additional data structures are defined and examples of their use are given so that no further definitional work on the structures is necessary. Author (GRA)

N76-15817# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
DIRECTIONS IN ARTIFICIAL INTELLIGENCE: NATURAL LANGUAGE PROCESSING
Ralph Grishman, ed. Aug. 1975 117 p refs Symp. held at New York, 6 Dec. 1974 Sponsored in part by NSF
(Contract N00014-67-A-0467-0032)
(AD-A014605; NSO-7) Avail: NTIS CSCL 05/7

The report contains proceedings of a symposium on natural language processing held at the Courant Institute of Mathematical Sciencies, New York University on December 6, 1974. The talks were concerned with the analysis of the structure among definitions in a dictionary, the automatic generation of semantic word classes by text analysis, the design of semantic hierarchies, and transformational language analysis procedures and underlying structures for information retrieval. GRA

N76-15818# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
A SURVEY OF SYNTACTIC ANALYSIS PROCEDURES FOR NATURAL LANGUAGE
Ralph Grishman Aug. 1975 100 p refs
(Contract N00014-67-A-0467-0032)
(AD-A014606; NSO-8) Avail: NTIS CSCL 05/7

The report includes a brief discussion of the role of automatic syntactic analysis, a survey of parsing procedures, past and present, and a discussion of the approaches taken to a number of difficult linguistic problems, such as conjunction and graded acceptability. It also contains precise specifications in the programming language SETL of a number of parsing algorithms. GRA

N76-15819# College of William and Mary, Williamsburg, Va. Dept. of Mathematics.
A HYBRID PROFILE REDUCTION ALGORITHM
Norman E. Gibbs Aug. 1975 23 p refs
(Contract N00014-73-A-0374-0001; NR Proj. 044-459)
(AD-A014438; TR-11) Avail: NTIS CSCL 12/1

A new algorithm for reducing the profile of a sparse matrix is described. Extensive testing of finite element matrices indicates that the algorithm typically produces profile comparable to the King Algorithm, yet does not exhibit King's sometimes erratic behavior. A listing of an implementation of the algorithm in FORTRAN is included in an appendix. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N76-15820# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
SUFFICIENT CONDITIONS FOR A CONTROL TO BE A STRONG MINIMUM
D. Q. Mayne Apr. 1974 9 p refs
(Publ-74/32) Avail: NTIS HC $3.50

An exact expression was used for the change in cost due to a change in control to obtain sufficient conditions for a control to be a strong minimum in the sense that comparison controls are merely required to be close in the L sub 1 sense. The expression is a natural extension of the result due to Weierstrass. ESA

N76-15821# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
AN INTEGRATED APPROACH TO COMPUTER AIDED DESIGN OF CONTROL SYSTEMS
M. D. Cripps and K. C. Daly Jun. 1974 6 p refs Presented at the Inst. of Elec. Engr. Computer Systems and Technol. Conf., London, Oct. 1974 Sponsored by Sci. Res. Council
(Publ-74/40) Avail: NTIS HC $3.50

The overall organization of the hardware, system software, and applications programs for a research project on the computer aided design of control systems is described. The aim of the project was to provide a flexible tool for the design engineer incorporating the latest advances in control theory and enabling tentative designs to be tested on a pilot plant. Applications packages covering the complete spectrum of control activity have been developed, and are run on a medium sized computer with sophisticated interactive graphic displays. A compatible small computer system with extensive analog facilities allows designs to be validated. Author (ESA)

N76-15822# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIFFERENTIAL OR SEQUENTIAL GAME OPTIMIZATION METHODS
Claude Aumasson Sep. 1974 74 p refs In FRENCH; ENGLISH summary
(ONERA-NT-219) Avail: NTIS HC $4.50

Research on optimal strategies in a differential or sequential game can be carried out either by the Bellman-Isaacs method (dynamic programming) or the Pontryagin method (principle of minimum-maximum). These two methods are presented and compared in the case of continuous time and of discreet time, for various optimality criteria (saddle point or minimax criteria). To simplify, only two-player, zero-sum games are considered, and the game domain is assumed sufficiently restricted not to include singularities. Results are applied to the particular case of linear-quadratic games. Author (ESA)

N76-15823# Stanford Univ., Calif.
DESCRIBING AUTOMATA IN TERMS OF LANGUAGES ASSOCIATED WITH THEIR PERIPHERAL DEVICES
R. Kurki-Suonio May 1975 39 p refs
(Grant NSF GJ-36473X)
(PB-244421/4; SU-STAN-CS-75-493) Avail: NTIS HC $4.00 CSCL 09B

A unified approach is presented to deal with automata having different kinds of peripheral devices. This approach is applied to pushdown automata and Turing machines, leading to elementary proofs of several well-known theorems concerning transductions, relationship between pushdown automata and context-free languages, as well as homomorphic characterization and undecidability questions. In general, this approach leads to homomorphic characterization of language families generated by a single language by finite transduction. GRA

N76-15824# Naval Research Lab., Washington, D.C.
SUFFICIENCY THEOREM FOR DISCONTINUOUS OPTIMAL COST SURFACES Interim Report
Harold L. Stalford 27 Jun. 1975 26 p refs
(RR0140201)
(AD-A014414; NRL-7903) Avail: NTIS CSCL 12/1

A V-type function is introduced for the purpose of modeling the optimal cost surfaces (OCS) of a very general class of optimal control processes, especially state-constrained processes. This classification of the OCS builds from the assumption that the OCS is the countable union of disjoint submanifolds. The V-type function is particularly suitable for handling OCSs that are discontinuous at submanifolds of codimension 1 of the state space. A discontinuous nontransversality condition is presented which keeps trajectories from entering any submanifold of the OCS from a discontinuous edge. A sufficiency theorem using the V-type function is given. This theorem states that if certain conditions are met by a control policy, than it is optimal. The defining of these conditions, together with the sufficiency theorem, provides a classification of the OCS for general optimal control processes with state constraints. An example is provided to demonstrate the implementation of the results. GRA

N76-15825# Perceptronics, Inc., Woodland Hills, Calif.
ADAPTIVE COMPUTER AIDING IN DYNAMIC DECISION PROCESSES: AN EXPERIMENTAL STUDY OF AIDING EFFECTIVENESS Semiannual Technical Report, 1 Oct. 1974 - 31 Apr. 1975
Kent B. Davis, Richard L. Weisbrod, Amos Freedy, and Gershon Weltman 1 May 1975 57 p refs
(Contract N00014-73-C-0286; ARPA Order 2347)
(AD-A014218; PTR-1016-75-5) Avail: NTIS CSCL 05/10

An experimental study was performed to evaluate (1) the effectiveness of adaptive decision aiding for improving decision maker (DM) performance and (2) the consistency of decision behavior in a given situation. Twelve Naval officers gathered intelligence about a simulated fishing fleet on an expanse of ocean and reported its status. Nine different types of sensors gave the operator a realistic set of decision alternatives. As he performed the task, the ADDAM (Adaptive Dynamic Decision Aiding Mechanism) System tracked the operator's decision behavior and estimated his utilities. These utility estimates are a measure of the relative worth of the information outcomes of each sensor placement. GRA

N76-15826# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPEECH UNDERSTANDING SYSTEMS Quarterly Technical Progress Report, 1 May - 1 Aug. 1975
William A. Woods, Richard M. Schwartz, Craig C. Cook, John W. Klovstad, and Lyn A. Bates Aug. 1975 56 p refs
(Contract N00014-75-C-0533; ARPA Order 2904)
(AD-A014608; BBN-3115; AI-34; QTPR) Avail: NTIS

The report covers research and development work done from 1 May to 1 August 1975 under the Speech Understanding Systems Contract No. N00014-75-C-0533. Areas included in this work are acoustic-phonetics, lexical retrieval, lexical verification, and natural language syntax, semantics, prosodics, and pragmatics. The report consists of two parts -- a brief survey of progress containing a few paragraphs describing the major progress in the individual components of the project, and a Technical Notes section containing detailed specifications of experiments performed, programs implemented, design studies, and, where appropriate, supporting data and appendices. This third QTPR contains such technical notes on handling of time expressions, procedural semantics for the travel budget management system, and control primitives for speech understanding strategies. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-15827# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Science Research Group.

A COMPUTATIONAL COMPARISON OF AN IMPROVED PAIR ASSIGNMENT ALGORITHM AND A PAIR EXCLUSION ALGORITHM FOR THE QUADRATIC ASSIGNMENT PROBLEM

Theunis H. C. Smith Nov. 1975 22 p refs Sponsored by CSIR

(RR-383) Avail: NTIS HC $3.50

The linear assignment problem relaxation of the quadratic assignment problem was used, and the pair assignment algorithm is essentially the same as that of Gavett and Plyter except that the optimal solution of the linear assignment problem was obtained at each subproblem in the tree search. The pair exclusion algorithm is based on the algorithm presented by Pierce and Crowston. Author

N76-15828# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Freiburg (West Germany). Inst. fuer Angewandte Mathematik und Mechanik.

CONSTRUCTION OF BOUNDS FOR THE BOUNDARY VALUE PROBLEM OF THE LINEAR ELLIPTIC DIFFERENTIAL EQUATION

Guenter Scheu and Ernst Adams 3 Jul. 1975 83 p refs In GERMAN; ENGLISH summary

(DLR-FB-75-47) Avail: NTIS HC $5.00; DFVLR, Cologne DM 24.40

Sequences of bounds, computable to the desired order of accuracy for the solution of the boundary value problem of the linear elliptic differential equation with constant coefficients in the n-dimensional hyperrectangle were constructed. At first the solution of the problem was expanded in a series. Since the series cannot be evaluated numerically, it was replaced by its N-th partial sum. To obtain bounds, functions were added to this sum which were constructed by use of the theory of differential inequalities. The sequences of bounds converge uniformly to the solution provided the functions in the problem satisfy certain smoothness conditions. The sequences of bounds were evaluated numerically up to N = 100 in two examples, and an application to the temperature field in a flow is discussed. Author (ESA)

N76-15829# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.

MULTIPLE DECISION RULES FOR COMPARING SEVERAL POPULATIONS WITH A FIXED KNOWN STANDARD

Bruce W. Turnbull Jun. 1975 27 p refs

(Contracts DAHC04-73-C-0008; N00014-67-A-0077-0020)

(AD-A014119; TR-257) Avail: NTIS CSCL 13/1

Independent observations are available from k univariate distributions indexed by a real parameter theta. It is desired to select that distribution with the largest parameter value unless this value is smaller than some fixed standard theta sub 0 in which case no distribution is to be selected. Various single+stage procedures for this (k+1)-decision problem are discussed, using indifference zone, decision theoretic, Bayesian, and subset selection approaches. GRA

N76-15830# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

MAXIMUM LIKELIHOOD APPROACHES TO VARIANCE COMPONENT ESTIMATION AND TO RELATED PROBLEMS Final Report, May 1973 - Mar. 1975

David A. Harville Jun. 1975 111 p refs

(AF Proj. 7071)

(AD-A014244; ARL-75-0175) Avail: NTIS CSCL 12/1

Several recent developments promise to increase greatly the popularity of maximum likelihood (ML) as a technique for estimating variance components. Patterson and Thompson (Biometrika, Vol. 58, December 1971, pp. 545-554) proposed a restricted maximum likelihood (REML) approach which takes into account the loss in degrees of freedom resulting from estimating fixed effects. Miller (Technical Report No. 12, Department of Statistics, Stanford University, 1973) developed a realistic asymptotic theory for ML estimators of variance components. There are many iterative algorithms that can be considered for computing ML or REML estimates of variance components. Some were developed specifically for the variance component problem and related problems. Others are general nonlinear optimization procedures. The computations on each iteration of these algorithms are those associated with computing estimates of fixed and random effects for given values of the variance components. MINQUE's of variance components can be computed from one iteration of the REML version of Anderson's (Annals of Statistics, Vol. 1, January 1973, pp. 135-141) iterative procedures.

Author (GRA)

N76-15831# Stanford Univ., Calif. Dept. of Computer Science.

THE DEPENDENCE GRAPH FOR BASES IN MATROIDS

Stein Krogdahl May 1975 33 p refs

(Contract N00014-70-A-9362-0001; Grant NSF GJ-36473; NR Proj. 044-402)

(AD-A014424; STAN-CS-75-495) Avail: NTIS CSCL 12/1

This paper discusses a certain graph, called the 'dependence graph' ('the DPG'), that can be defined naturally for a given independent set in a matroid. The author is mainly concerned with the DPG of bases, and the author studies what the DPG of a base tells about the matroid. It is shown that there is a nice connection between the DPG and duality, and between the DPG and connectivity for matroids. This last fact leads to an algorithm for determining the connected components of a matroid and also to one for computing a circuit containing two given distinct elements in the same such component. A simple algorithm using depth-first search is given for solving this last problem for graphic matroids. GRA

N76-15832# Stanford Univ., Calif. Dept. of Computer Science.

NUMERICAL EXPERIMENTS WITH THE SPECTRAL TEST

R. William Gosper May 1975 34 p refs

(Contract N00014-70-A-0362-0001; Grant NSF GJ-36473; NR Proj. 044-402)

(AD-A014429; STAN-CS-75-490) Avail: NTIS CSCL 12/1

Following Marsaglia and Dieter, the spectral test for linear congruential random number generators is developed from the grid or lattice point model rather than the Fourier transform model. Several modifications to the published algorithms were tried. One of these refinements, which uses results from lesser dimensions to compute higher dimensional ones, was found to decrease the computation time substantially. A change in the definition of the spectral test is proposed in the section entitled 'A Question of Independence'. GRA

N76-15833# Watervliet Arsenal, N.Y.

REDUCTION OF A COUPLED DUAL TRIGONOMETRIC SERIES TO A SET OF SINGULAR INTEGRAL EQUATIONS AND THEIR SOLUTIONS

M. A. Hussain and S. L. Pu Jun. 1975 27 p refs

(AD-A014187; WVT-TR-75038) Avail: NTIS CSCL 12/1

In this paper we study a coupled pair of dual trigonometric series that arise in the study of contact problem of an inclusion as well as a set of curvilinear cracks. The dual series is reduced to a coupled pair of integral equations. Simple identities of the Kernel functions allow us to decouple these integral equations into a set of uncoupled singular integral equations. One of these integral equations has a logarithmic singularity and the other has a Cauchy type of singularity. The problem is then reformulated via a complex variable approach, and reduced to a Riemann-Hilbert problem leading to identical results. This equivalence may be useful in numerical computations if exact solutions cannot be obtained. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-15834*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE FEASIBILITY OF REAL-TIME PREDICTION OF AIRCRAFT CARRIER MOTION AT SEA
Menahem Sidar and Brian F. Doolin Jun. 1975 25 p refs
(NASA-TM-X-62454; A-6169) Avail: NTIS HC $3.50 CSCL 13J

The ability to predict the aircraft carrier's motion over an interval of several seconds within reasonable error bounds may allow an improvement in touchdown dispersion and a more certain value for ramp clearance due to a smoother aircraft trajectory. Also, improved information to the landing signal officer should decrease the number of waveoffs substantially. It is quantitatively shown that, based on the power density spectrum data for pitch and heave measured for various ships and sea conditions, the motion can be predicted well for up to 15 seconds. The zero crossover times for both pitch and heave motions can be predicted with impressive accuracy. The predictor was designed on the basis of Kalman's optimum filtering theory for the discrete time case, adapted for real-time digital computer operation. Author

N76-15835# Clemson Univ., S.C. Dept. of Mathematical Sciences.
ESTIMATION OF SELECTED PARAMETERS IN NON-HOMOGENEOUS POISSON PROCESSES
Paul T. Holmes and Douglas E. Huffman Jan. 1975 69 p refs
(Contract N00014-75-C-0451; NR Proj. 042-271)
(AD-A014104) Avail: NTIS CSCL 12/1

Estimates are found for the intensity function and other related parameters in a non-homogeneous Poisson process. Asymptotic results are also obtained. GRA

N76-15836# Naval Surface Weapons Center, Dahlgren, Va.
USER'S GUIDE AND PROGRAM MAINTENANCE MANUAL FOR THE EXTENDABLE COMPUTER SYSTEM SIMULATOR. VERSION 15: INSTRUMENTATION PACKAGE
Edward J. Glynn and Maxine S. Yagla Aug. 1975 202 p refs
(AD-A014594; NSWC/DL-TR-3284-Version-15) Avail: NTIS CSCL 09/2

A software Instrumentation Package for use with the Extendable Computer System Simulator, Version 15 was written to facilitate the reporting of systems performance statistics in discrete system simulations. The software package was developed in the course of modeling the TRIDENT Strategic Weapon Fire Control System. The Instrumentation Package (IP) complements the Extendable Computer System Simulation language by creating data structures for statistics collection and by providing the mechanism for initialization, update and output of the contents of these structures. The end result of the IP is a set of specialized output reports which describe the activity of a simulated computing system during a user specified time interval. This report outlines the user input procedures and report options available with the software package. Detailed descriptions of the statistical collection methods, the functions of the IP routines and the interactions of the IP routines are included. Methods for updating the IP are also delineated. The software system is operational on the CDC 6700 computer at the Naval Surface Weapons Center, Dahlgren Laboratory, and the IBM 360/91 computer at the Applied Physics Laboratory, Johns Hopkins University. GRA

N76-15837# Minnesota Univ., Minneapolis. Dept. of Physics.
SIMULATED RANDOM SEQUENTIAL FILLING OF SPACE BY NON-TOUCHING UNIFORM SPHERES Final Report, May 1973 - Dec. 1974
Howard G. Hanson Aug. 1975 31 p refs
(Contract N00014-67-A-0113-0033)
(AD-A014618) Avail: NTIS CSCL 09/2

A computer method study is presented of filling space with uniform size, non-touching spheres in a random sequential fashion until saturation prevents adding additional spheres. A saturation value of .710 sphere centers/unit volume (corresponding to a packing fraction of .372) is deduced after attempts to analyze the probability of voids remaining in the distribution. An empirical expression is developed for the probability of accommodating a sphere on the Xth random attempt which appears valid for large X. Nearest neighbor distributions are determined for the first twelve neighbors and average distances for the first thirty neighbors. Radial densities are compared with previous work by Scott, Finney, and Tory showing maxima and minimia. Evidence indicates a slight tendency for 'shells' of approximately eight neighbors to form about any given sphere. Nearest neighbor pairs (defined as adjacent spheres which are each others' nearest neighbor) are counted as accounting for approximately a half of the sphere population. A study of neighbors of any given sphere with which the given sphere could collide head-on if in straight line motion yields an overall average of approximately five such neighbors per sphere. Probability data is given for head-on neighbors. GRA

N76-15838# Naval Postgraduate School, Monterey, Calif.
MODELING A RANDOM SEARCH
Bruno O. Shubert Jul. 1975 25 p refs
(AD-A014558; NPS-55SY75071) Avail: NTIS CSCL 12/2

A model for random search is considered which differs from the classical random search by modeling the random paths of the searcher and/or target as those of a Wiener process. The quantity of interest is the distribution of detection time for a cookie cutter mode of detection. Only one-dimensional search is considered here. Author (GRA)

N76-15839# Naval Postgraduate School, Monterey, Calif.
A SEQUENTIAL MEDIAN TEST WITH APPLICATIONS TO CEP TESTING
Donald R. Barr and Thomas D. Burnett Jul. 1975 65 p refs
(AD-A014554; NPS-55BN75071) Avail: NTIS CSCL 12/1

A sequential test of a simple hypothesis of the distribution of a random variable against a simple alternate hypothesis is proposed. The test terminates as soon as one of a sequence of sequentially observed sample medians falls outside a 'continuation region'. The test can also be used for hypotheses concerning the median of the sampled population, and is especially useful when hypothesized distributions may provide poor fit in the tails, in which case 'outliers' may seriously degrade the performance of traditional procedures such as the Sequential Probability Ratio Test. Applications to testing hypotheses about the circular error probable of weapon systems are discussed, and the tables of stopping bounds for such tests are presented. Author (GRA)

N76-15840# Control Analysis Corp., Palo Alto, Calif.
SIMULATING STABLE STOCHASTIC SYSTEMS. 7: SELECTING BEST SYSTEM
Donald L. Iglehart Jul. 1975 31 p refs
(Contract N00014-72-C-0086; NR Proj. 047-106)
(AD-A014468; TR-86-17) Avail: NTIS CSCL 12/2

In this paper the author continues the study of the regenerative method for analyzing simulations of stable stochastic systems. Methods are proposed here for selecting the best system from among k systems according to a prescribed criterion function. GRA

N76-15841# Control Analysis Corp., Palo Alto, Calif.
STATISTICAL ANALYSIS OF SIMULATIONS
Donald L. Iglehart Jul. 1975 27 p refs
(Contract N00014-72-C-0086; NR Proj. 047-106)
(AD-A014467; TR-86-18) Avail: NTIS CSCL 12/1

This Paper contains an expository account of the regenerative method for simulating stable stochastic systems. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-15842# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A NETWORK ORIENTED LANGUAGE. A NEW APPROACH TO NETWORK DESIGN, USING INTERACTIVE GRAPHICS
N. Marovac and W. S. Elliott May 1974 11 p refs
(Publ-74/33) Avail: NTIS HC $3.50

A language for the design of any network, using interactive

graphics as an aid to the design process is proposed. The language, NOL-1, is a higher level problem-oriented programming language. It is based on the network definition language NEDLAN and associated mechanisms and it incorporates definition, decision and control, dynamic graphical input and output, and analysis statements. Combining all these statement types with due regard to ergonomic factors in the use of interactive graphics for designing networks, a network-oriented higher level language to be used with interactive graphics is obtained. Author (ESA)

N76-15843# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
DEADLINE SCHEDULING FOR A REAL TIME MULTIPROCESSOR
H. H. Johnson and M. S. Maddison (Brit. Post Office) May 1974 10 p refs
(Publ-74/43) Avail: NTIS HC $3.50

A real time multiprocessor is considered where each program has a firm response time or a deadline before which its processing must be completed otherwise the program is deemed to have failed in the sense that any output obtained is valueless. Similar work for a single processor system is reviewed and comparable ideas were used for the multiprocessor situation. The results presented include a simple test of the feasibility of processing a queue of programs, which predisposes the acceptance or rejection of a new arrival and a scheduling procedure. The procedure guarantees, if it is followed, that the queue will be successfully processed and that a subsequent new arrival will have the best chance of being accepted for processing. Author (ESA)

N76-15844# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
CANONICAL FORMS FOR IDENTIFICATION
D. Q. Mayne Jun. 1974 13 p refs
(Publ-74/49) Avail: NTIS HC $3.50

The problem of identification, that is the determination or estimation of a system from input-output data, is discussed. It is shown how canonical forms may be employed to achieve uniqueness for the inverse problems of identification of deterministic and stochastic linear, finite, time-invariant systems, as well as for the related problems of minimal realization (of input-output) and spectral factorization. Author (ESA)

N76-15845# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
TERMINAL INTERFACE MESSAGE PROCESSOR: USER'S GUIDE TO THE TERMINAL IMP, REVISION
J. Malman Aug. 1975 68 p Revised Prepared in cooperation with Stanford Res. Inst., Menlo Park, Calif.
(Contract F08606-75-C-0032; ARPA Order 2351)
(AD-A014398; BBN-2183-Rev-75; NIC-10916) Avail: NTIS CSCL 09/2

This report describes the use of a terminal connected to a Terminal IMP (TIP) in the ARPA Network. The report assumes that the user knows how to operate a server Host system somewhere on the network once he becomes connected to that system, and the report defines the procedures and options the user has available to establish that connection. The ARPA Network, IMPs and TIPs, hardware maintenance, TIP operation, and formats and protocols are not described here. GRA

N76-15846# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
MAXIMIZING THE MINIMUM SOURCE-SINK PATH SUBJECT TO A BUDGET CONSTRAINT: ANOTHER VIEW OF THE MINIMUM COST FLOW ROUTINE
D. R. Fulkerson and Gary Harding Aug. 1975 14 p refs
(Contract N00014-75-C-0622; Grant NSF MPS-74-24026; NR Proj. 044-439)
(AD-A014422; TR-268) Avail: NTIS CSCL 05/1

Consider a network in which each arc has a traversal time and a cost for increasing its traversal time. If a fixed budget is available for expenditure on arcs of the network, how does one allocate this budget among the arcs so as to maximize the length of a shortest path from source to sink. It is shown that the minimum cost flow algorithm can be used to solve this problem parametrically in the budget. GRA

N76-15847# Pennsylvania State Univ., University Park. Applied Research Lab.
ACCURATE FOURIER ANALYSIS OF ARBITRARY FUNCTIONS DEFINED BY DISCRETE DATA VALUES
M. W. McBride 26 Mar. 1975 24 p
(Contract N00014-73-C-1418)
(AD-A014214; TM-75-78) Avail: NTIS CSCL 12/1

A computerized analysis has been developed to determine the Fourier coefficients of arbitrary functions defined by discrete point values. The method described in this report is more accurate than the trapezoidal integration technique commonly used. Basically, the technique is a summation of exact integrals defined in small regions by a Taylor Series expansion of the data. Derivatives necessary for the expansion are determined by a parametric spline curve function, fitting the original data. The parametric spline is described briefly. Examples of the use and accuracy of a coefficient computation program are presented. The described method is shown to have twice the accuracy of the previous method for equal computation times. The ultimate accuracy of the method is shown to be an order of magnitude better than that of the older method. GRA

N76-15039* Aerling, Bedford, Ind.
OPERATIONAL CONSIDERATIONS FOR THE AIRSHIP IN SHORT-HAUL TRANSPORTATION
Charles D. Walker *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 261-266 refs (For availability see N76-15015 06-01)
CSCL 12B

N76-15040* Maiersperger (Walter P.), Monterey, Calif.
DESIGN ASPECTS OF ZEPPELIN OPERATIONS FROM CASE HISTORIES
Walter P. Maiersperger *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 267-283 refs (For availability see N76-15015 06-01)
CSCL 12B

N76-15041* California Dept. of Transportation, Sacramento.
LIGHTER THAN AIR: A LOOK AT THE PAST, A LOOK AT THE POSSIBILITIES
William F. Shea *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 285-295 refs (For availability see N76-15015 06-01)
CSCL 12B

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-15848# College of William and Mary, Williamsburg, Va. Dept. of Mathematics.
THE RECONSTRUCTION CONJECTURE FOR TOURNAMENTS IS FALSE
Paul K. Stockmeyer Aug. 1975 14 p refs
(Contract N00014-73-A-0374-0001; NR Proj. 044-459)
(AD-A014436; TR-9) Avail: NTIS CSCL 12/1

The conjecture that for all sufficiently large p any tournament of order p is uniquely reconstructable from its point-deleted subtournaments is shown to be false. Counterexamples are presented for all orders of the form (2 sup n) - 1 and (2 sup n) -2. The largest previously known counterexamples were of order eight. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-15849# Philips Broadcast Equipment Corp., Montvale, N.J. Government Systems Div.
SECOND GENERATION IR SENSOR DESIGN ANALYSIS Final Report, 1 Sep. 1974 - 30 Jan. 1975

30 Jan. 1975 42 p
(Contract DAAK02-73-C-0101)
(AD-A014486; GSDR-784) Avail: NTIS CSCL 17/5

The investigations and analyses performed during the course of this program lead to the following conclusions: A 3 - 5 micrometer, TE cooled IR system can be built using on focal plane CCD electronic processing technology, to yield high performance; Using CCD's, large arrays of detectors can be used which require few output leads from the dewar, thus decreasing mechanical complexity and heat loads; PbSe, because of its high impedance makes an ideal detector to interface with CCD's with several input scheme possibilities; A parallel scan system is used to conserve bandwidth and optimize scan efficiency; Individual row detector signals are delayed and added to reduce the requirements on the output shift register and background suppression; The requirements of the guidelines system can be achieved using a 540 element PbSe array; A family of systems, using modular techniques and high density array TE detectors can be built to meet a multiplicity of applications. GRA

N76-15850# Xerox Electro-Optical Systems, Pasadena, Calif.
INVESTIGATION OF 2ND GENERATION MODULAR FLIR SIGNAL PROCESSING/DISPLAY TECHNOLOGIES Final Report
R. A. Aguilera Nov. 1974 130 p refs
(Contract DAAK02-74-C-0406)
(AD-A014358; Rept-7462) Avail: NTIS CSCL 17/5

The primary purpose of this report is to identify specific areas of signal processing and display techniques where advanced concepts might be used to improve the performance of the next generation of FLIR systems. To accomplish this objective it was necessary to first of all define the general signal processing and display techniques used in the current generation of FLIR systems, then to identify the particular shortcomings of these systems based upon a postulated set of design rules, and then to propose specific areas of improvement to overcome the identified shortcomings of the current generation. Based upon these findings, recommendations are made for further development efforts in specific areas of advanced signal processing and display techniques. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-15851 Northwestern Univ., Evanston, Ill.
EFFECTS OF STRAIN IN BULK AND THIN FILM SURFACE ACOUSTIC WAVE DEVICES Ph.D. Thesis
Ashok Laxmanrao Nalamwar 1975 110 p
Avail: Univ. Microfilms Order No. 75-29718

A detailed study of the effects of strain on the propagation of surface acoustic waves (SAW) was performed. An analytical model was developed to investigate the effects of several mechanisms which contribute to a change in the velocity of propagation of the surface acoustic wave in a strained medium. Analytical methods, in which iterative procedures in digital computation are employed, were used for the calculation of SAW velocities. The original computer programs were modified to allow for the presence of stress in the propagating media. Experimental results for the case of bulk substrates were obtained for SAW devices made of YX quartz and YZ lithium niobate. A technique to RF sputter well-oriented (crystallographically) thin films of ZnO was developed with good reproducibility. SAW devices made of sputtered ZnO films on nonpiezoelectric substrates were fabricated and characterized. Strain effects in such devices were investigated analytically and experimentally using fused quartz substrates. Excellent agreement between computed results and measured values was obtained. Dissert. Abstr.

N76-15852*# Purdue Univ., Lafayette, Ind. Ray W. Herrick Labs.
PROPAGATION OF HIGH AMPLITUDE HIGHER ORDER SOUNDS IN SLIGHTLY SOFT RECTANGULAR DUCTS, CARRYING MEAN FLOW
K. S. Wang and P. G. Vaidya Nov. 1975 36 p refs
(Grant NsG-3029)
(NASA-CR-146069; HL-75-35; Rept-4) Avail: NTIS HC $4.00 CSCL 20A

The resonance expansion method, developed to study the propagation of sound in rigid rectangular ducts is applied to the case of slightly soft ducts. Expressions for the generation and decay of various harmonics are obtained. The effect of wall admittance is seen through a dissipation function in the system of nonlinear differential equations, governing the generation of harmonics. As the wall admittance increases, the resonance is reduced. For a given wall admittance this phenomenon is stronger at higher input intensities. Both the first and second order solutions are obtained and the results are extended to the case of ducts having mean flow. Author

N76-15853# Texas Univ., Austin. Applied Research Labs.
CHARACTERIZATION OF ACTIVE UNDERWATER ACOUSTIC CHANNELS. PART 1: A NEW FORMULATION FOR SCATTERING BY RANDOM MEDIA AND INTERFACES
David Middleton Dec. 1974 115 p refs
(Contract N00024-75-C-6078)
(AD-A014111; ARL-TR-74-61-Pt-1) Avail: NTIS CSCL 20/1

A general approach to scattering phenomena is developed and applied specifically to underwater acoustic scattering situations involving the medium and its interfaces. The fundamental elements of the method are the development of the available scattering elements into a hierarchy of independent scatter processes, based on the scatters activated, at any given instant. This along with the governing class of Langevin equation permits a corresponding development, in linear superposition, of the received scattered field x sub m as a hierarchy of independent processes representing different scales of inhomogeneity. Author (GRA)

N76-15854# Texas Univ., Austin. Applied Research Labs.
CHARACTERIZATION OF ACTIVE UNDERWATER ACOUSTIC CHANNELS. PART 2: SCATTERING IN AN ISOVELOCITY OCEAN
David Middleton Dec. 1974 246 p refs
(Contract N00024-75-C-6078)
(AD-A014112; ARL-TR-74-61-Pt-2) Avail: NTIS CSCL 20/1

The general approach to scattering phenomena developed earlier is applied to underwater acoustic scattering problems in an isovelocity medium which has no absorption and inhomogeneous properties other than the various scattering mechanisms. Results are presented and discussed. Author (GRA)

N76-15855# Naval Research Lab., Washington, D.C.
CREEPING WAVES AND LATERAL WAVES IN ACOUSTIC SCATTERING BY LARGE ELASTIC CYLINDERS Ph.D. Thesis - Catholic Univ. of Am. Interim Report
George V. Frisk 1 Jul. 1975 100 p refs
(NRL Proj. S01-70.401; ZF52552003)
(AD-A014412; NRL-7914) Avail: NTIS CSCL 20/1

The connection between creeping wave and flat surface wave theory is established by investigating the limit of acoustic scattering from a solid elastic cylinder, imbedded in a fluid, whose radius tends to infinity. First, the asymptotic behavior of the complex circumferential wave numbers is calculated by substituting the appropriate Debye- or Airy-type asymptotic expansions into the 3 x 3 secular determinant and solving it using iterative techniques. It is found that, in the limit of infinite cylinder radius, the wave numbers of the Rayleigh and Stoneley modes tend toward those of the Rayleigh and Stoneley waves on a flat elastic half-space, while the Franz mode wave numbers tend toward the wave number of sound in the fluid. The longitudinal and transverse Whispering Gallery mode wave numbers tend toward the longitudinal and transverse wave numbers in the solid. Graphical results are presented for an aluminum cylinder in water (and in one case, also in vacuum) and show good agreement with existing numerical results. Then, using the Watson-Sommerfeld transformation, the limiting behavior of the solution to the problem of the scattering of a cylindrical wave from a cylinder whose radius tends to infinity is investigated. Using the analytic expressions for the creeping wave numbers, it is shown that the residue sums corresponding to the different

classes of circumferential waves tend individually toward the different types of surface waves found on the flat surface. GRA

N76-15856# Naval Underwater Systems Center, New London, Conn.
CROSS-SPECTRAL PROPERTIES OF SOME COMMON WAVEFORMS IN THE PRESENCE OF UNCORRELATED NOISE
Alan E. Markowitz 6 Aug. 1975 36 p refs
(NUSC Proj. A-134-03; SF11121702)
(AD-A014425; NUSC-TR-4947) Avail: NTIS CSCL 20/1

The magnitude coherence and phase for a number of common waveforms in the presence of uncorrelated noise is derived mathematically and presented graphically. Discussion is limited to waveforms resulting from the combination of no more than two traveling waves. The effects of the relative magnitude of the traveling wave components, as well as the uncorrelated noise, are seen. The effect of wave speed is also noted. Finally, the periodicity with respect to frequency, observed in the resultant plots, is shown to be significant and is a reflection of the relative wave speeds. A table summarizing the results is also presented. GRA

N76-15857# Department of Transportation, Albany, N.Y. Engineering Research and Development Bureau.
EFFECTS OF SELECTED PAVEMENT SURFACE TEXTURES ON TIRE NOISE Interim Report
Robert J. Mitrey, Duane E. Amsler, and David E. Suuronen May 1975 24 p refs Sponsored by Federal Highway Admin., Washington, D. C.
(Proj. 60-1)
(PB-244089/9; NYSDOT-ERD-75-RR-28) Avail: NTIS HC $3.50 CSCL 13B

Modern methods of surface texturing to enhance concrete pavement skid-resistance by increasing texture depth resulted in increased tire-pavement noise, as compared to older finishing practices. Measurements of noise associated with textured concrete pavements representing the range of current and past practice in New York State are reported. A high correlation was found between the depth of textures created by brooming and burlap dragging, as measured by the sand patch method, and the A-weighted sound level of a single vehicle passing over those textures. Methods for measuring texture parameters and tire-pavement noise are described in appendices. GRA

N76-15858# Federal Highway Administration, San Francisco, Calif. Acoustic Lab.
POROUS FRICTION COURSES AND ROADWAY SURFACE NOISE Final Report
Robert A. Kay and Jerald K. Stephens Mar. 1975 39 p
(PB-244624/3) Avail: NTIS HC $4.00 CSCL 20A

This study was made to determine whether skid resistant open graded asphaltic friction courses produce greater tire noise than other more commonly used highway surfaces. The noise level of open graded asphaltic friction surfaces was compared to noise levels of three other roadway surfaces: asphalt coated dense graded, portland cement concrete, and chip seals. Three types of tires were tested on each of these surfaces: mud and snow, standard rib, and radial rib recaps. Field test results indicate that the open graded asphaltic friction courses generally produces slightly lower noise levels than asphalt coated dense graded surfaces, portland cement concrete, or chip seals. Radial rib recaps were found to be slightly more quiet than standard rib tires, both were noticeably quieter than mud and snow tires. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-15859 Polish Academy of Sciences, Warsaw.
THEORY OF MOLECULAR NETWORKS AND CONDENSED POLYMER NETWORKS [TEORIA SIECI MOLEKULARNYCH I SKONDENSOWANYCH UKLADOW POLIMEROWYCH]
A. Ziabicki 24 Jul. 1975 224 p refs In POLISH
Avail: Issuing Activity

Articles are presented on the concepts and problems of the network theory. Topics discussed include: the network as a molecular modelar of polymer systems; topological structure, thermodynamics, and properties of a network of localized nodes; statistical theory of entanglements in polymers and fibers; thermodynamic deformation of insulated polymer chains; statistical mechanics of a network of constants in a finite number of points; and kinematics and dynamics of macroparticles in diluted solutions and network systems. Transl. by M.J.S.

N76-15860* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEUTERIUM PASS THROUGH TARGET Patent
Donald L. Alger, inventor (to NASA) Issued 2 Dec. 1975 7 p Filed 27 Aug. 1974 Supersedes N74-32719 (12 - 22, p 2672)
(NASA-Case-LEW-11866-1; US-Patent-3,924,137; US-Patent-Appl-SN-500980; US-Patent-Class-250-499; US-Patent-Class-250-500) Avail: US Patent Office CSCL 20H

A neutron emitting target for use in neutron generating apparatus including a deuteron source and an accelerator vacuum chamber, comprised of a tritium-containing target layer, a deuteron accumulation layer, and a target support containing passages providing communication between the accumulation layer and portions of the surface of the support exposed to the accelerator vacuum chamber is described. With this arrangement, deuterons passing through the target layer and implanting in and diffusing through the accumulation layer, diffuse into the communicating passages and are returned to the accelerator vacuum chamber. Continuous removal of deuterons from the target in conventional water cooled neutron generating apparatus is provided. Preferably, the target is provided with thin barrier layers to prevent undesirable tritium diffusion out of the target layer, as well as deuteron diffusion into the target layer.
Official Gazette of the U.S. Patent Office

N76-15861 California Univ., Davis.
ISOTOPE SEPARATION BY LASER DEFLECTION OF AN ATOMIC BEAM Ph.D. Thesis
Anthony Frederick Bernhardt 1975 108 p
Avail: Univ. Microfilms Order No. 76-1777

Separation of isotopes of barium was accomplished by laser deflection of a single isotopic component of an atomic beam. With a tunable narrow linewidth dye laser, small differences in absorption frequency of different barium isotopes were exploited to deflect atoms of a single isotopic component of an atomic beam through an angle large enough to physically separate them from the atomic beam. It is shown that the principal limitation on separation efficiency, the fraction of the desired isotopic component which can be separated, is determined by the branching ratio from the excited state into metastable states.
Dissert. Abstr.

N76-15862 California Univ., San Diego.
LOW ENERGY ELECTRON SCATTERING FROM ATOMIC OXYGEN AND OTHER NEUTRAL GASES Ph.D. Thesis
Richard Charles Dehmel 1975 126 p
Avail: Univ. Microfilms Order No. 75-29435

The results of two experiments are reported on the scattering of low-energy electrons by neutral gases using the modulated crossed-beam technique. In the first experiment, measurements were made on the ratio of forward to backscattering of electrons in the energy range 3-20 eV by He, O, Ar, H2, N2, and O2. It is found that atomic oxygen has an anomalously strong forward scattering at the lower energies. Agreement is found between the present results for He, Ar, H2, and N2 and the ratios calculated from previously published differential cross-section measurements except for H2 and N2 at the lower energy limit. In the second experiment, measurements were made on the differential cross-sections for electrons scattered by He, O, Ar, and O2 at 15eV and by O and O2 at 5 eV. Measurements on O2 extend to larger backscattered angles. A small angle dip in the cross-section is observed which is not predicted by the theory.
Dissert. Abstr.

N76-15863# Montpellier Univ. (France). Dept. de Physique Mathematique.
MULTIPLE SCATTERING EXPANSIONS FOR THE IONIZING SCATTERING AMPLITUDE OF THREE BODY ATOMIC COLLISIONS
F. Vella May 1975 19 p refs
(PM/75/8) Avail: NTIS HC $3.50

The off-the-energy shell extensions in the whole complex energy plane of the Coulomb partial wave t-matrix are written as separable expansions of Gegenhauer functions. The behavior, on the energy shell, of these expansions, is also discussed. In the case of a break-up process of a three-body atomic collision these expressions for the partial wave t-matrix are substituted into the first order multiple scattering approximation of the scattering amplitude. As an illustration the cross section for ionization of atomic hydrogen by electron impact is calculated in this way and compared with that obtained by R. Akerib and S. Borowitz. Author (ESA)

N76-15864# Montpellier Univ. (France). Dept. de Physique Mathematiquz.
INVERSE PROBLEM FOR COMPLEX R SUP(VECTOR A) ANALYTIC POTENTIALS OF FINITE RANGE
Ilia Miodek May 1975 20 p refs
(PM/75/10) Avail: NTIS HC $3.50

A solution is presented to the inverse problem for the Schroedinger equation at fixed energy for complex r sup (vector a)analytic potentials of finite range. This is done using an interpolation formula for the regular radial solutions as functions of complex angular momentum. The interpolation formula is derived by Frobeniu's techniques and Cauchy's theorem. As an application an inverse problem for a spherically symmetric cold plasma perturbed by a small oscillatory electric potential of fixed (finite) frequency was studied. Author (ESA)

N76-15865# Montpellier Univ. (France). Dept. de Physique Mathematique.
A MECHANISM FOR GENERATING NARROW STATES
F. M. Renard May 1975 8 p refs
(PM/75/11) Avail: NTIS HC $3.50

A symmetry property can lead simultaneously to meson broad states and to narrow states. The origin of the symmetry breaking with respect to the properties of the narrow states recently discovered is discussed. Author (ESA)

N76-15866# Illinois Univ., Urbana. Dept. of Chemistry.
ENERGETIC AND DYNAMICAL ASPECTS OF PROTON TRANSFER REACTIONS IN SOLUTION
R. A. Marcus Aug. 1975 20 p refs Presented at Proton Transfer Symp. no. 10, Faraday Div., Chem. Soc.
(Contract N00014-75-C-0942; NR Proj. 359-585)
(AD-A014097; TR-1) Avail: NTIS CSCL 07/4

Several energetic and dynamical aspects of proton transfers are treated. The effect of intrinsic barrier asymmetry on BEBO calculated Bronsted plots is investigated, and contributions to work terms are also considered. The dynamics of transfer of a light particle between two heavier ones is discussed for a particular potential energy surface, making use of classical trajectories, semiclassical concepts, and a previous quantum study. The question of nonequilibrium polarization of solvent is also considered. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-15867# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
INFLUENCE OF STRONGLY FLUX-LIMITED ELECTRON THERMAL CONDUCTION ON BURN OF LASER IMPLODED DT SPHERES
K. Appert Jul. 1975 11 p refs Sponsored by Swiss Natl. Sci. Found.
(LRP-94/75) Avail: NTIS HC $3.50

Electron thermal conduction plays an important role in the dynamics of laser-imploded fusion material such as DT pellets. By comparison of plane target experiments to one-dimensional hydrodynamic calculations, it was found that the electron thermal conduction could have anomalously low values due to some microturbulence or due to internally generated magnetic fields. Another detrimental effect of decreasing thermal flux is pointed out. It is shown by numerical calculations using MEDUSA, a one-dimensional Lagrangian hydrodynamics code, that low thermal conductivity makes it difficult to tune the laser pulse. The region of pulse parameters leading to position energy gain shrinks seriously with decreasing thermal conductivity. (ESA)

N76-15868# Mathematical Applications Group, Inc., Elmsford, N.Y.
ADDITIONAL ADJOINT MONTE CARLO STUDIES OF THE SHIELDING OF CONCRETE STRUCTURES AGAINST INITIAL GAMMA RADIATION Final Report
Mendel Beer and Martin O. Cohen Feb. 1975 79 p refs
(Contract DCPA01-74-C-0221; AF Proj. 7093)
(AD-A014504; MR-7043) Avail: NTIS CSCL 18/6

The adjoint Monte Carlo method previously developed by MAGI has been applied to the calculation of initial radiation dose due to air secondary gamma rays and fission product gamma rays at detector points within buildings for a wide variety of problems. These provide an in-depth survey of structure shielding effects as well as many new benchmark problems for matching by simplified models. Specifically, elevated ring source results were obtained in the following areas:-- doses at on-and off-centerline detectors in four concrete blockhouse structures; doses at detector positions along the centerline of a high rise structure without walls; dose mapping at basement detector positions in the high rise structure; doses at detector points within a complex concrete structure containing exterior windows and walls and interior partitions; modeling of the complex structure by replacing interior partitions by additional material at exterior walls; effects of elevation angle changes; effects on the dose of changes in fission product ambient spectra; and modeling of mutual shielding due to external structures. In addition, point source results yielding dose extremes about the ring source average were obtained. Author (GRA)

74 OPTICS

Includes light phenomena.

N76-15869# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
DEVELOPMENT OF AN OPTICAL RATE SENSOR Final Report, 1 Apr. 1974 - 28 Feb. 1975
James L. Skripka and Ronald J. Fredricks Apr. 1975 236 p refs
(Contract N00014-74-C-0382)
(AD-A014505; GRR-005-0675) Avail: NTIS CSCL 17/7

This report documents the results of a feasibility investigation program of optical rate sensing by a unique technique of differential phase shift measurement between counter-traveling light beams forming a closed path. The program involved the design, build, and test of a discrete component research test model of the sensor, and an investigation of the applicability of integrated optics technology to such a sensor. Such a sensor possesses many of the attributes of the ring laser gyro without the problem of frequency lock-in which is characteristic of that device. It also offers the potential advantage of size reduction without performance degradation through the use of multiple turns of fiber optics for an effective area increase and replacement of the gas laser with a solid state source. The purpose of the program was to evaluate a complete sensor using the research test model and to determine how well integrated optics can be applied to the optical rate sensor. The results indicate that fiber optics and the solid state laser can be used to overcome problems encountered in the discrete component model and to achieve performance in the one-half to ten degree per hour bias

stability range in a sensor configured for a maximum rate of 400 degrees/second. An optical rate sensor using only integrated optics components, although promising, requires further research developments in the field of integrated optics. Author (GRA)

N76-15870# Electro-Optical Research Co., Los Angeles, Calif.
QUANTIFICATION OF ATMOSPHERIC CONSTITUENTS AND PARAMETER MEASUREMENT Final Report
May 1975 77 p refs
(Contract DAAK02-74-C-0262)
(AD-A014239; EOR-166-75-F) Avail: NTIS CSCL 20/6

The objective of this program is to measure and quantify the atmospheric constituents affecting the transmission and absorption of infrared radiation. To understand and determine the degradation of infrared imaging and laser transmissometers under battlefield conditions, atmospheric constituents must be quantified. Specifically, the parameters of interest are the concentration of atmospheric gases including CO2, CH4, CO, O3, and H2O as well as aerosol size and distribution. GRA

N76-15871# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
BAND MODEL PARAMETERS FOR THE 2.7 MICROMETER BANDS OF H2O AND CO2 IN THE 100 TO 3000 K TEMPERATURE RANGE Interim Report
Stephen J. Young 31 Jul. 1975 60 p refs
(Contract F04701-71-C-0076; DARPA Order 2843)
(AD-A014248; TR-0076(6970)-4; SAMSO-TR-75-209) Avail: NTIS CSCL 20/6

Sets of band model parameters for H2O and CO2 in the 2.7 micrometer spectral region and consistent for the entire temperature range from near-ambient atmospheric temperatures (about 200K) to gas combustion temperatures (about 2500K), are constructed. These constructions are accomplished by joining together band model parameters derived from the AFCRL atmospheric absorption line data compilation (LINAVE parameters) and parameters tabulated in the NASA Handbook of Infrared Radiation from Combustion Gases (NASA parameters). The former set adequately describes the low-temperature variation of the parameters but is inadequate for some high-temperature applications. The latter set is suitable for high-temperature applications but fails for some low-temperature cases. Examples of the deficiencies of these two sets are presented by comparison with experimental absorption and emission spectra for low- and high-temperature gas samples. The adequacy of the combined band model parameter set (COMB parameters) is demonstrated by comparison with the same experimental data. Criteria for and examples of the construction of the combined sets are given, and tabulations of the parameter sets are included. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-15872 Wisconsin Univ., Madison.
PLASMA LOSS IN THE LEVITATED TOROIDAL OCTUPOLE Ph.D. Thesis
Alfred Joseph Cavallo 1975 211 p ref
Avail: Univ. Microfilms Order No. 75-19058

Loss to the ring can be measured without supports or obstacles near the ring obscuring details of plasma behavior. A new kind of particle collector was developed for these studies, a sub-Debye interdigitated striped collector. The electric field of this collector does not penetrate more than a Debye length into plasma nearby, thus minimizing any disturbance to the bulk of the plasma by the collector. Loss to the walls of the octupole was measured with 40 sq cm striped collector patches distributed around the machine, and with collectors mounted on a moveable cart. Loss to the rings was measured by 320 sq cm striped collector bands wrapped around the minor circumference of a ring. Loss information could be telemetered from the rings via a modulated light beam, with all wires, probes and supports removed from the vicinity of the ring. Dissert. Abstr.

N76-15873# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MODIFIED NONLINEAR SCHROEDINGER EQUATION FOR ALFVEN WAVES PROPAGATING ALONG THE MAGNETIC FIELD IN COLD PLASMAS
K. Mio, T. Ogino, K. Minami, and S. Takeda Sep. 1975 24 p refs
(IPPJ-231) Avail: NTIS HC $3.50

The basic nonlinear equation which describes the Alfven waves, with small but finite amplitude propagating along the magnetic field in cold plasmas was derived modifying a reductive perturbation method. Then as a result, the nonlinear dispersion relation was obtained through a procedure which clarifies the physical meaning. Furthermore, a modified nonlinear Schrodinger equation is proposed which describes the modulated Alfven wave more correctly than previous works. The analysis agrees well with the numerical calculation of the initial value problem using the basic equations. Author

N76-15874# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANALYTICAL MODEL FOR SUPER-COMPRESSION OF MULTI-STRUCTURED PELLET
T. Yabe and K. Niu Sep. 1975 16 p refs
(IPPJ-230) Avail: NTIS HC $3.50

A one-dimensional analytical model which can be applied to the super compression of the multi-structured pellet is presented. The main result shows that the time dependence of the input power E for the optimal compression is given by E infinity (1 - t/t sub s)/(3G+1)/2G where G=(rho1/rho2) to the 1/4th power, rho1 and rho2 are the densities of the D-T fuel and the high Z material respectively, and t sub s is the characteristic time interval. Author

N76-15875# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ELEMENT SEPARATION EFFECTS IN THE BOUNDARY REGION OF A PLASMA SURROUNDED BY NEUTRAL GAS
B. Lehnert May 1975 14 p refs
(TRITA-EPP-75-09) Avail: NTIS HC $3.50

A one-dimensional model of a fully ionized plasma, separated from a neutral gas by a homogeneous magnetic field directed along the plasma boundary, was developed. The plasma and the neutral gas consist of two different types of ions and neutral particles. In a stationary state the outflux of plasma by diffusion across the magnetic field is compensated by an influx of neutrals which are ionized in a partially ionized boundary region. It was found that the ratio between the ion densities in the fully ionized region will in general differ from the density ratio of the two types of neutrals being present in the gas region. This provides a separation mechanism which can be applied both to cosmic and laboratory plasmas, such as the abundance anomalies in magnetic variable stars and in the solar wind, and separation processes of non-identical ions and neutral atoms in gas blanket systems. Author (ESA)

N76-15876# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron Physics.
CURRENT CHOPPING SPACE CHARGE LAYERS IN A LOW PRESSURE ARC PLASMA
S. Torven and M. Babic Apr. 1975 6 p refs Presented at the 12th Intern. Conf. on Phenomena in Ionized Gases (ICPIG 12), Eindhoven, Neth., Aug. 1975
(TRITA-EPP-75-11) Avail: NTIS HC $3.50

Chopping of the electric discharge current as occurring in the positive column of low pressure mercury arcs was investigated. Such chopping is accompanied by a rapid increase of the tube resistance. The high tube voltage drops occurring when the current is stabilized by the external circuit were found to be concentrated to a single space charge layer, which forms across the column. Simultaneously, microwave emission and fast electrons can be detected. For currents close to the instability threshold, small amplitude voltage pulses were found to propagate along the column with the ion sound speed. Author (ESA)

N76-15877# Royal Inst. of Tech., Stockholm (Sweden). Dept of Plasma Physics and Fusion Research.
THE INTERACTION OF A PLASMA STREAM WITH SOLID BODIES

L. Kristoferson May 1975 54 p refs
(TRITA-EPP-75-12) Avail: NTIS HC $4.50

The interactions of a proton plasma of several hundred electronvolts with different solid targets was investigated with interferometric and spectrographic techniques. Observations of the atmosphere formed around the targets showed considerable differences between the targets. The cloud density is inversely dependent of the heat of sublimation of the target material, and the density difference between e.g. gold and polyethene targets is one order of magnitude. Sputtering and other erosion mechanisms on the target material together with piled up stream particles give the main contributions to the cloud around the targets. Desorbed impurities may however play a great role in the initial stage of the interaction. Author (ESA)

N76-15878# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

PLASMA-NEUTRAL GAS BOUNDARY LAYERS

B. Lehnert 23 May 1975 26 p refs
(TRITA-EPP-75-13) Avail: NTIS HC $4.00

The plasma-neutral gas balance in the partially ionized transition region situated between a fully ionized magnetically confined plasma and an adjacent neutral gas cloud is considered. A well-defined boundary layer can develop between the plasma and the neutral gas, but only within certain ranges of the relevant parameters such as the plasma density and the magnetic field strength. Consequently, such layers are expected to appear in the atmospheres of normal and magnetic variable stars and in other more dense cosmic clouds of matter, as well as in impermeable laboratory plasmas. Sharply defined boundary layers are unlikely to appear in the low-density regions of interstellar and interplanetary space where the plasma becomes permeable to neutral gas and the partially ionized transition region has a minimum depth of the order of 5 times 10 to the l8th power/n sub b m, where n sub b is the corresponding characteristic plasma density. Author (ESA)

N76-15879# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

ION-ION COLLISIONS AND ELEMENT SEPARATION EFFECTS IN THE BOUNDARY REGION OF A PLASMA SURROUNDED BY NEUTRAL GAS

B. Bonnevier May 1975 21 p refs
(TRITA-EPP-75-14) Avail: NTIS HC $3.50

In particular a simple formula is derived for the separation between different kinds of constituents. This separation depends on different collision cross sections for diffusion and seems to be especially large when resonant charge exchange collisions are involved. These diffusive processes of importance in impermeable plasmas are also compared with separation processes due to a difference in ionization potential, which is known to occur in permeable plasmas. Different isotopes have the same ionization potential and the same charge exchange cross sections. The separation processes described above are therefore likely to give element but not isotope separation. Author (ESA)

N76-15880# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.

SCREW PINCH FEEDBACK STABILIZATION EXPERIMENT [EXPERIENCE DE STABILISATION D'UN SCREW PINCH PAR RETROACTION]

R. Keller, A. Pochelon, and W. Bachmann Jun. 1975 22 p refs In FRENCH; ENGLISH summary Sponsored by Fonds Natl. Suisse de la Rech. Sci.
(LRP-93/75) Avail: NTIS HC $3.50

Preliminary results are presented of the feedback kink stabilization of a screw pinch using an amplifier operating at reduced power. The principal problems to be overcome in the field of detection and action upon the plasma column, conditioned by the dispersion relation are discussed. ESA

N76-15881# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.

EMISSION OF LONGITUDINAL WAVES FROM THE INTERACTION OF TWO BEAMS OF TRANSVERSE RADIATION

E. S. Weibel Aug. 1975 21 p refs Sponsored by Swiss Natl. Sci. Found.
(LRP-95/75) Avail: NTIS HC $3.50

When two beams of electromagnetic radiation having finite diameter intersect within a plasma they generate in the interaction volume a second order charge density which is proportional to the amplitudes of both beams. Provided that a resonance condition is satisfied this charge density acts as directional antenna emitting longitudinal waves. In this process power is transferred from the beam of higher frequency to the beam of lower frequency with the excess going into the longitudinal waves. The power emitted is P=P sub 1 P sub 2/P* where P sub i are the powers of the electromagnetic beams. P* is computed for both Langmuir and sound waves. In the first case this process can probably be used as a means to measure the plasma density locally. Author (ESA)

N76-15882# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

NON-STATIONARY ANALYSIS OF OHMIC AND VISCOUS HEATING OF A CYLINDRICAL PLASMA SHELL

D. Ohlsson 20 Sep. 1975 27 p refs
(TRITA-EPP-75-19) Avail: NTIS HC $4.00

Possible heating mechanisms for a cylindrical plasma shell confined in an axial magnetic field were investigated. Two different cases were studied, namely ohmic and viscous heating of a rotating plasma and ohmic heating of a static plasma. The nonstationary plasma fluid equations were solved by using a numerical code. Of primary interest are the maximum temperatures obtained by ohmic heating of a static plasma. It is shown that, in the first classical approximation, it is possible to reach temperatures of around t=200,000-400,000'k at plasma densities, magnetic field strengths, and induced current of the order n=10 to the 21st power/cu m, B=1 tesla and J=100 kA. The particle momentum, and heat losses along the magnetic field lines were neglected. Author (ESA)

N76-15883# Naval Research Lab., Washington, D.C.

ACTIVATION COUNTERS FOR PULSED NEUTRON SOURCES Interim Report

F. C. Young and S. J. Stephanakis Aug. 1975 34 p refs
(NRL Proj. H02-26F; DNA Proj. NWED-QAXLA014)
(AD-A014584; NRL-MR-3104) Avail: NTIS CSCL 20/9

Three different types of activation counters have been tested and used for neutron diagnostics on pulsed plasmas produced with intense relativistic electron beams. Each counter employs the activation of silver, rhodium, or lead respectively. The advantages of each detector are pointed out, and limitations due to dead-time losses or neutron-scattering effects are carefully documented. Absolute calibrations have been made for radioactive sources and for d(d,n)3He and t(d,n)alpha pulsed neutron sources. GRA

N76-15884# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

POWER TESTS WITH THE AFAPL KIVA-I MHD GENERATOR Interim Technical Report, Jan. 1972 - Jan. 1973

James F. Holt May 1975 83 p refs
(AF Proj. 3145)
(AD-A014338; AFAPL-TR-74-99) Avail: NTIS CSCL 10/2

The AFAPL open cycle MHD facility, KIVA-I, was operated for the purpose of maximizing power output. This was accomplished through a process of adjusting the various operating conditions of the system. Maximum power of 210 kw was achieved with a magnetic field strength of 2.3 Tesla. Input propellant was 0.6 kg/sec of toluene oxidized by gaseous oxygen. Theoretical analysis of the data is in most respects in agreement with the observations. Electrode voltage drops of around 100 volts are deduced, with a total diagonal channel output voltage of 1200 volts. A dc-dc converter was applied for stepping up the output to 50 kv. Author (GRA)

N76-15885# Naval Research Lab., Washington, D.C.

ANOMALOUS TRANSPORT COEFFICIENTS FOR HANE APPLICATIONS DUE TO PLASMA MICRO-INSTABILITIES

Martin Lampe, Wallace M. Manheimer, and K. Papadopoulos Jun. 1975 85 p refs
(AD-A014411; NRL-MR-3076) Avail: NTIS CSCL 20/9

The authors present a complete summary of anomalous plasma transport theory, as it is presently used in the NRL multi-fluid HANE coupling codes. Anomalous transport due to five different microinstabilities -- magnetized ion-ion, unmagnetized ion-ion, modified two-stream, ion sound, and beam cyclotron -- is covered. The principal results, turn-on conditions and anomalous transport coefficients, are first presented in a concise form suitable for ready reference, and use in future fluid codes. The detailed theory of each micro-instability, including derivations of the transport coefficients, discussion of assumptions, and summaries of the particle simulation results for each instability, is then discussed in a series of appendices. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N76-15886 Polish Academy of Sciences, Warsaw.
CERTAIN THEORIES OF CRYSTALLIZATION [O PEWNYCH TEORIACH KRYSTALIZACJI]
Kryztyna Szumilin 22 Sep. 1975 32 p refs In POLISH
Avail: Issuing Activity

Special theories on the problem of crystallization as a phase transformation are considered. Topics discussed include instability of solid bodies, liquid instability, phase equilibrium, Lindemann criteria, molecular fields or the Weiss field, the Lennard-Jones theory, and the Kirkwood-Monroe theory. Transl. by M.J.S.

N76-15887 Princeton Univ., N.J.
SUPERCONDUCTIVITY IN SMALL METAL BRIDGES Ph.D. Thesis
Eric Cabot Hannah 1975 149 p
Avail: Univ. Microfilms Order No. 76-250

Josephson effects in weaklinks are discussed for low and high frequency regimes using simple perturbation techniques. It is proven that no measurement of the supercurrent dependence upon frequency above the Riedel peak frequency can be made using RF sources whose frequencies are below the Riedel peak. The bulk of work done in the field on the high frequency structure of the Josephson current is shown to be invalid. Metal bridges shorter than a newly defined temperature independent length for superconductors are proven to be identical in their Josephson current behavior to tunneling junctions. The BCS gap equation is generalized to include voltage gradient effects on pairs within the bridge. The oscillation frequency for long bridges is shown to be limited to less than 10 Hz. An experimental test of the voltage dependent gap is made as well as tests of the pair reforming time of bridges. Dissert. Abstr.

N76-15888 Northwestern Univ., Evanston, Ill.
ULTRASONIC STUDY OF LIQUID CRYSTALS Ph.D. Thesis
Kenjiro Miyano 1975 126 p
Avail: Univ. Microfilms Order No. 75-29711

The ultrasonic velocity and attenuation in magnetically aligned liquid crystals were measured. The purpose of the experiments was to investigate the anisotropic hydrodynamic (low-frequency and long-wavelength limit) properties of various liquid crystal symmetries. The anisotropy in the hydrodynamic behavior was then related to the microscopic structure. Nematic, cholesteric, and smectic-A, B, and C symmetries were studied. Ultrasonics is well suited for measuring hydrodynamical quantities, but in some cases the sound frequencies were such that deviations from the hydrodynamical limit appeared. In such cases a wide range of frequencies (2-36 MHz) was used to extrapolate to zero frequency. Dissert. Abstr.

N76-15889 Northwestern Univ., Evanston, Ill.
FIRST PRINCIPLES CALCULATIONS OF LOCAL PROPERTIES OF SOLIDS Ph.D. Thesis
Ernest Byrom 1975 168 p
Avail: Univ. Microfilms Order No. 75-29593

Many properties of solids depend mainly on the local environment within the solid, and may be amenable to treatment by a cluster model; That model was studied through calculations in the Hartree-Fock-Slater approximation, by the discrete variation method. The HFS equations are solved in a model potential, generated from a sum of free atom or ion charge densities. The potential due to the crystal outside the cluster is included in the model potentials, and as a fixed exterior potential when the cluster solution is iterated to self consistency. In metal clusters, problems associated with charge transfer between the cluster and the bulk of the crystal are examined. For magnetic systems, spin unrestricted calculations are made. The eigenvalues are compared to band theory energy levels and experimental spectra. From the eigenfunctions, charge and spin densities are calculated, with particular attention to Mossbauer isomer shifts, neutron scattering from factors, and transferred hyperfine fields. Dissert. Abstr.

N76-15890 Purdue Univ., Lafayette, Ind.
SPECIFIC HEAT AND MAGNETIZATION OF THE SUPERCONDUCTORS: OSMIUM AND THE MONOXIDES OF NIOBIUM AND TITANIUM Ph.D. Thesis
Ali Mohamed Okaz 1975 129 p
Avail: Univ. Microfilms Order No. 76-572

The specific heat of a pure polycrystalline osmium sample (resistivity ratio 500) was measured between 0.18 and 4.2 K in zero magnetic field. The transition from superconducting to normal state occurs at To = 0.638 + or - 0.002 K. In the normal state, the coefficient of the electronic contribution is 2.050 + or - 0.003 mJ/sq mole K, and the Debye temperature at absolute zero. The critical field parameter deduced from specific heat data is 77.5 gauss, and the maximum deviation of the critical field curve from the parabolic law is 4.3%. The value of the superconducting energy gap derived from gamma To, and Hc(0), is 3.55 kBTo and the gap is found to be nearly isotropic. Some microscopic parameters as the Ginzburg-Landau parameter, the coherence length, the London penetration depth, and the electron mean free path are calculated using experimental quantities found in this research. Dissert. Abstr.

N76-15891 Louisiana State Univ. and A&M Coll., Baton Rouge.
ELECTRICAL CONDUCTIVITY IN SUPERIONIC CONDUCTORS AND NARROW-BAND MATERIALS Ph.D. Thesis
Mukesh Eswaran 1975 157 p
Avail: Univ. Microfilms Order No. 76-140

A generalized moment method allows for the calculation of the conductivity for arbitrary carrier and impurity concentrations and, in the case of narrow-band materials, for random magnetization. In narrow-band materials, the electronic conductivity vanishes for a half-filed band, and in the absence of impurities it increases approximately linearly with the number of empty or doubly occupied lattice sites. In the absence of electron-electron scattering, the impurity limited conductivity varies as the product of the hole and electron concentrations. Numerical results indicate that to eithin 3% a generalized Matthiessen's rule holds; the resistivities due to impurities and electron-electron interactions are addictive. An upper bound on the conductivity of strongly interacting electrons in narrow-band materials is obtained. The model of a planar antiferromagnet is used to explain the anisotropic conductivity of nickel sulfide below the Neel temperature. Dissert. Abstr.

N76-15892# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
FIRST PRINCIPLES CALCULATIONS OF BULK, SURFACE AND EXTRINSIC PROPERTIES OF CRYSTALS Final Report, 1 Jul. 1974 - 30 May 1975
Robert N. Euwema Jun. 1975 18 p
(AF Proj. 7885)
(AD-A014242; ARL-75-0152) Avail: NTIS CSCL 20/2

The core approximation suggested by Bonifacic and Huzinaga was coded into the crystal Hartree-Fock programs. Calculations were performed on diamond, including the carbon 1s core and excluding the 1s core but including in its place the model Hamiltonian proposed by Bonifacic and Huzinaga. Energy bands, Compton profiles, X-ray structure factors and the cohesive energy were compared in detail. The conclusions were that this core approximation is extremely successful. It should prove very useful in all future crystalline and thin film Hartree-Fock calculations. Thin film unrestricted Hartree-Fock programs were written for the (111) planes of diamond. The programs are in the final

states of debugging. Preliminary experience indicates that the programs will be extremely expensive to run. Consequently, attention is currently being focussed on developing further techniques for speeding up the crystal and thin film programs. Excitation equations for many-body systems have been set up which show that a general description in terms of self-energy effects, such as relaxation and correlation, and particle-hole interactions is possible. If certain criteria are met, these equations take on a simple form. Calculations have been done on atomic Be and Ne and a good comparison with experiment was obtained. At present calculations are being set up for crystalline LiF. Author (GRA)

N76-15893# California Inst. of Tech., Pasadena. Engineering and Applied Science.
EXPLORATORY STUDY ON MICROANALYSIS OF THIN FILMS BY BACKSCATTERING TECHNIQUES Semiannual Progress Report, 15 Aug. - 31 Dec. 1974
James W. Mayer and Marc-A. Nicolet 24 Jan. 1975 37 p refs
(Grant NSF AER-73-03265)
(PB-244818/1; NSF/RA/N-75-068) Avail: NTIS HC $4.00 CSCL 20L

The experimental investigations of solid-phase epitaxial growth of Si layers indicate the usefulness of 4He(+) MeV backscattering techniques in analyzing interdiffusion processes in thin film systems. Uniform Si layers with thicknesses of about 1 micrometer and areas of square centimeters can now be grown epitaxially on Si substrates through metal films at approximately 500C. The transport kinetics of the evaporated Si (amorphous) through a metal film (Pd-silicide, in this case) were investigated. The transport rate seems to be controlled by surface reactions. The authors identified some of the important parameters (such as cleanliness of the interfaces and the rate of temperature rise during annealing) for controlling the quality of the grown layers. GRA

N76-15894# Princeton Univ., N.J. Dept. of Chemistry.
INTERACTIONS IN INORGANIC MOLECULAR CRYSTALS: ELECTRONIC SPECTRA OF ReF SUB 6 PURE AND MIXED CRYSTALS Technical Report, 1 Jul. - 31 Dec. 1975
E. R. Bernstein and G. R. Meredith 25 Aug. 1975 114 p refs Presented at 28th Ohio State Mol. Spectry. Conf., 9-14 Jun. 1974, paper no. TD 5 Sponsored in part by NSF and Army
(Contract N00014-67-A-0151-0032)
(AD-A014464; TR-8) Avail: NTIS CSCL 07/4

Electronic absorption spectra of ReF6 Quintet d1 are obtained for the pure crystal and UF6, MoF6, and WF6 mixed crystals. The observed transition arises from an intra-configurational t2g to t2g promotion. The pure crystal is predicted to undergo a magnetic phase transition below ca. 1.5K. Pair spectra, two-molecule transitions, the ground state Jahn-Teller effect, linewidths, and vibrational assignments are discussed. The major mechanism for pair coupling and magnetic ordering is identified as superexchange through low lying delocalized charge transfer bands. These interactions are qualitatively discussed and energy localizing and delocalizing interactions are separated. GRA

N76-15895# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EBS (ELECTRON BOMBARDED SEMICONDUCTOR) RF AMPLIFIER DESIGN
Daniel F. Kostishack 31 Jul. 1975 80 p refs
(Contract F19628-76-C-0002; AF Proj. 627A)
(AD-A014256; TN-1975-44; ESD-TR-75-239) Avail: NTIS CSCL 20/12

This report presents a comprehensive design criteria for EBS RF power amplifiers which incorporates all pertinent design parameters associated with both the electron beam and semiconductor diode targets. The derivation of the design model is described in detail, and an example amplifier design is carried out yielding an optimum set of device specifications and summary of predicted performance. Author (GRA)

N76-15896# Arizona Univ., Tucson. Optical Sciences Center.
MODULATION SPECTROSCOPY OF DISORDERED SOLIDS Final Report, 15 Jan. 1974 - 30 Jun. 1975
B. O. Seraphin 15 Aug. 1975 75 p refs
(Grants DAHC04-74-G-0000; DA-ARO(D)-31-124-73-G106) (AD-A014268) Avail: NTIS CSCL 20/12

Two problems were faced at the beginning of this reporting period. The first was the problem of interference fringes hiding the intrinsic response in the infrared below the absorption edge. The other problem was one of the general interpretation of the thermoreflectance spectra of amorphous semiconductors. The authors studied compositions in the Ge-Te alloy system. Through this research it was hoped to learn more about the electronic structure of the system, and also to develop modulation spectroscopy into a viable method for studying amorphous materials. The separation of the structures agree well with the separation of peaks found in the valence band density of states from photoemission studies. Much work has been done in expressing the thermoreflectance in terms of the electronic structure, in particular the density of states profiles of the valence and conduction bands. A procedure has been developed for modeling the density of states profiles to give a theoretical modulated response resembling the experimental data. GRA

N76-15897# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THREE STAGE MICRO COOLER
V. A. Nayer, V. S. Martynovskii, and I. Ya. Khirich 21 Jan. 1975 8 p refs Transl. into ENGLISH from Kholodiln. Tekhn. (USSR), no. 7, 1969 p 24-27
(AD-A014236; FSTC-HT-23-0452-75) Avail: NTIS CSCL 20/12

To determine the properties, in particular the thermophysical properties, of various materials in a wide range of temperatures, local sources of cooling are necessary with smooth regulation of temperature. To carry out investigations at temperatures with a lower limit of -80 to 90C, thermoelectric cooling systems are useful, for example, a three-stage thermoelectric device. In the laboratory of semiconducting cooling of the Odessa Technological Institute of the Food and Refrigeration Industry, a three-stage microcooler was developed and tested. The cooler has crystalline semiconducting materials of the following composition: p-type-75 mol-% Sb2 Te3 - 25 mol.% Bi2 Te3 - 4 percent by weight Te - 1 percent by weight Se; n-type-90 Mol-% Bi2 Te3 - 10 Mol.% Bi2 Se3 -0.13 percent by weight Hg2 Cl2. These crystals were grown by the Bridgeman-Stokbarger method. GRA

N76-15898# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PHOTOCONDUCTOR NOISE MEASUREMENTS Interim Report
Norman F. Stahlberg 31 Jul. 1975 50 p refs
(Contract F04701-75-C-0076)
(AD-A014249; TR-0076(6270-20)-1; SAMSO-TR-75-207) Avail: NTIS CSCL 17/5

The nature of the noise mechanisms that occur in photoconductive materials is summarized, and a brief analysis of the electrical circuit conventionally employed with photoconductors is given. The equations for the specific noise (N1) and specific responsivity (S1) of a photodetector are derived in detail. The noise characteristics of amplifiers are examined in general, and some practical guidelines are offered for making noise measurements. A brief introduction to spectral analysis and signal averaging is given, including a comparison between discrete and continuous averaging methods. The noise spectrum measurement capability of a typical instrumentation system is analyzed with respect to photoconductive devices. Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N76-15899# Illinois Univ., Urbana. Dept. of Psychology.
DEVELOPMENT AND RESEARCH UTILIZING THE PLATO 4 SYSTEM FOR COMPANY COMMANDER BEHAVIORAL CHANGE TRAINING Final Report, 16 Jul. 1973 - 20 Aug. 1974
Jerry L. Cohen and Martin Fishbein Aug. 1975 107 p refs
(Contract N61339-73-C-0129)
(AD-A014213; NAVTRAEQUIPC-73-C-0129-1) Avail: NTIS CSCL 05/9

An investigation of the possible utilization of the PLATO IV System as a behavioral change training device for use with company commanders at Recruit Training Command, San Diego, was undertaken. Working within the theoretical framework developed by Fishbein, questionnaire data was collected to assess the possible relationships among attitudes and specific task-oriented behaviors. On the basis of the results from these measures, computer-assisted instructional materials were initially developed for use on the PLATO IV System. This report presents summaries of the data analyses and the framework of the developed computer programs. GRA

N76-15900# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EDUCATIONAL TECHNOLOGY PROGRAM Quarterly Technical Summary Report, 1 Mar. - 31 May 1975
Frederick C. Frick 15 Jun. 1975 11 p refs
(Contract F19628-73-C-0002; AF Proj. 2199)
(AD-A014255; ESD-TR-75-204) Avail: NTIS CSCL 05/9

Field tests of the stand-alone system (LTS-3S) were successfully carried out for the U.S. Bureau of Mines. Performance tests of the improved audio reader suggest that the present reader design will meet the requirements for the LTS-5 prototype. Work has been initiated on the development of a student data-recording system. Author (GRA)

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-15901*# Stanford Research Inst., Huntsville, Ala.
USER BENEFITS AND FUNDING STRATEGIES Final Report, May - Oct. 1975
J. L. Archer, N. A. Beauchamp, and C. F. Day Oct. 1975 157 p refs
(Contract NAS5-22371)
(NASA-CR-144706) Avail: NTIS HC $6.75 CSCL 05A

The justification, economic and technological benefits of NASA Space Programs (aside from pure scientific objectives), in improving the quality of life in the United States is discussed and outlined. Specifically, a three-step, systematic method is described for selecting relevant and highly beneficial payloads and instruments for the Interim Upper Stage (IUS) that will be used with the space shuttle until the space tug becomes available. Viable Government and private industry cost-sharing strategies which would maximize the number of IUS payloads, and the benefits obtainable under a limited NASA budget were also determined. Charts are shown which list the payload instruments, and their relevance in contributing to such areas as earth resources management, agriculture, weather forecasting, and many others. J.R.T.

N76-15902*# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
STUDIES AND ANALYSES OF THE MANAGEMENT OF SCIENTIFIC RESEARCH AND DEVELOPMENT, INCLUDING IMPLEMENTATION AND APPLICATION AT NASA CENTERS
Albert H. Rubenstein Aug. 1975 29 p refs
(Grant NGL-14-007-062)
(NASA-CR-145922) Avail: NTIS HC $4.00 CSCL 05A

Summary results obtained through the Program of Research on the Management of Research and Development (POMRAD) were presented. The nature of the overall program and the specific projects undertaken were described. Statistical data is also given concerning the papers, publications, people, and major program areas associated with the program. The actual list of papers, names of doctoral and masters theses, and other details of the program are included as appendices. Author

N76-15903# Naval Surface Weapons Center, White Oak, Md.
A MANAGEMENT APPROACH IN ACCIDENT PREVENTION Final Report
William T. Fine Jul. 1975 43 p
(AD-A014562; NSWC/WOL/TR-75-104) Avail: NTIS CSCL 05/1

A loss control system is described which employs management introspect for determining the underlying causes of accidents and hazardous situations, and improves the overall effect of accident prevention activities. Monetary and productive waste and losses, as well as accidents, are reduced by using accidents and hazards as indicators to detect management failures. Procedures are outlined, together with examples which demonstrate how the investigation of minor injuries and unsafe conditions can identify the management failures which are causing huge hidden losses as well as accidents. A logical method is given to track the primary cause of accidents and hazards back to the underlying management failures. Management failures are placed in general categories and summarized to determine and locate problem areas. GRA

N76-15904# Army Aviation Systems Command, St. Louis, Mo.
ARMY AVIATION RDT AND E PLAN: EXECUTIVE SUMMARY Edition No. 4
Jul. 1975 23 p refs
(AD-A014196) Avail: NTIS CSCL 01/3

The Army Aviation Research, Development, Test and Engineering (RDT and E) Plan is the U.S. Army Aviation Systems Command (USAAVSCOM) response to the requirement for a Consolidated R and D Plan (CRDP), which constitutes Block 13a in the Life-Cycle Management Model (LCMM) as described in the Joint CDC/AMC Materiel Need Procedures Handbook, March 1972. This Plan is prepared and maintained by AVSCOM on a continuing basis to address the short- and long-range RDT and E activities directed to achieving the Army objectives for which AVSCOM is responsible. This Plan presents a time-phased analysis and presentation of the scientific and technological programs required to support the development of advanced airmobile systems responsive to the future needs of the Army. This document sets forth plans and objectives for Army aviation research and development activities for the FY76-95 period, with particular emphasis on the period from the present to 1980. Current R and D efforts in Army air mobility are directed primarily toward the development of a family of vertical and short takeoff and landing aircraft to fulfill identified requirements in the land combat functions of mobility, intelligence, firepower, combat service support, and command, control and communications. The Plan (either the classified or unclassified version) is quite voluminous because of the broad scope of activities and the wide variety of technologies and disciplines that constitute the totality of the air vehicle technology. GRA

N76-15905# National Bureau of Standards, Washington, D.C. Experimental Technology Incentives Program.
PROCEEDINGS OF PROCUREMENT PRACTICES SYMPOSIUM FEDERAL, STATE AND LOCAL Final Report
Theodore F. Fody and Joseph G. Berke 30 May 1975 168 p Symp. held 28-30 Jan. 1975 Sponsored in part by Federal Supply Service, Natl. Assoc. of State Purchasing Officials, Natl. Inst. of Governmental Purchasing, Inc.
(COM-75-11210/2; NBSIR-75-716) Avail: NTIS HC $6.75 CSCL 15E

The general objectives of the conference are to recommend ways to encourage information interchange and interaction between federal, state and local procurement levels and industry; to explore the use of special incentives such as life cycle costing, value incentives clauses, and unsolicited proposals as a means to promote innovation in products purchased by all levels of government; to establish the interrelationship between

marketing, R and D and procurement and develop approaches to acquire the latest technology through the procurement process; to explore various product testing and evaluation efforts such as certification programs, tests by independent, company owned association laboratories, university and government laboratories. GRA

N76-15906# Systems Research Labs., Inc., Dayton, Ohio.
A PROCEDURE FOR QUANTIFICATION OF TECHNOLOGICAL CHANGES ON HUMAN RESOURCES Interim Report
Norman R. Potter, Kenneth D. Forkan, and Duncan L. Dieterly (AFHRL, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio AFHRL Jun. 1975 93 p refs
(Contract F33615-74-C-4019; AF Proj. 7907)
(AD-A014335; AFHRL-TR-75-33) Avail: NTIS CSCL 05/5

A long standing research objective of the human factors psychologist has been the capability to predict the human resource requirements of new equipment. An even more intriguing problem is the prediction of human resource requirements based on the introduction of new technology. The purpose of this study was to locate and apply an existing method, or to develop a new procedure for quantifying the effects of incoming technology. A procedure integrating the Design Option Decision Tree (DODT) with a modificaton of the method of summated ratings was developed to permit quantification of specific human resource components at each of the design options represented in the DODT. Using judgmental data collected from an Air Force operational unit, the method developed under this study effort was evaluated. It was concluded that quantifying human resource components associated with hardware design options by means of a technique incorporating a DODT and a modification of the method of summated ratings was a feasible approach and could provide one methodological procedure for measuring the effects of advances in technology on human resources. See also AD-A014332 and AD-A014333. GRA

N76-15907# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DECISION MAKING AND TRAINING: A REVIEW OF THEORETICAL AND EMPIRICAL STUDIES OF DECISION MAKING AND THEIR IMPLICATIONS FOR THE TRAINING OF DECISION MAKERS Research Report, Jun. 1973 - Jul. 1975
R. S. Nickerson and C. E. Feehrer Aug. 1975 226 p refs
(Contract N61339-73-C-0128)
(AD-A014490; NAVTRAEQUIPC-73-C-0128-1) Avail: NTIS CSCL 05/1

This report reviews theoretical and empirical studies of decision making. The purpose of the review was to identify results that would be applicable to the problem of training decision makers. The literature on decision making is extensive. However, relatively few studies have dealt explicitly with the problem of training in decision-making skills. The task, therefore, was to gather from the general literature on decision making any implications that could be found for training. Decision making is conceptualized here as a type of problem solving, and the review is organized in terms of the following component tasks: information gathering, data evaluation, problem structuring, hypothesis generation, hypothesis evaluation, preference specification, action selection, and decision evaluation. Implications of research findings for training are discussed in the context of descriptions of each of these tasks. A general conclusion drawn from the study is that decision making is probably not sufficiently well understood to permit the design of an effective general-purpose training system for decision makers. Systems and programs could be developed, however, to facilitate training with respect to specific decision-making skills. The development of more generally applicable training techniques or systems should proceed in an evolutionary fashion. Training is one way to improve decision-making performance; another is to provide the decision maker with aids for various aspects of his task. Because training and the provision of decision aids are viewed as complementary approaches to the same problem, the report ends with a discussion of several decision-aiding techniques that are in one or another stage of study or development. Author (GRA)

N76-15908# Sowle (Don) Associates, Inc., Arlington, Va.
ACQUISITION RESEARCH PROGRAM: A STARTING POINT
Jul. 1975 59 p refs
(Contract N00014-75-C-0849; NR Proj. 274-241)
(AD-A014115) Avail: NTIS CSCL 15/5

Seven projects have been proposed as the starting point for a concerted program of research aimed at strengthening the Navy Systems acquisition process. The proposed research would focus on special aspects of the following subjects: acquisition research center; mission needs and goals; competition among systems; the acquisition team; truth in negotiations; claims and disputes; logistic support; and Navy electronic systems management. The results of the proposed research projects are expected to pave the way for the development of more effective major systems and large reductions in the time and money that must be invested in their acquisition. These benefits are expected to result through such improvements as: clearer statement of mission needs and goals; better understanding of Navy major systems programs by Congress, industry, the press, and the public; more effective competition in the development of major systems; better source selection procedures; improved logistic support; simplified lower-cost paperwork; and reduction in the number and size of claims and disputes. For each of the seven proposed research projects, the report outlines a work statement and discusses relevant background, previous improvement efforts, reference material, current research, and anticipated benefits. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library sciencz.

For computer documentation see *61 Computer Programming and Software*.

N76-15909*# Computer Sciences Corp., El Segundo, Calif. Industrial Management Systems Dept.
AN INTRODUCTION TO THE MARSHALL INFORMATION RETRIEVAL AND DISPLAY SYSTEM
Sep. 1974 41 p
(Contract NAS8-21805)
(NASA-CR-144108; MA-006-001-2H) Avail: NTIS HC $4.00 CSCL 05B

An on-line terminal oriented data storage and retrieval system is presented which allows a user to extract and process information from stored data bases. The use of on-line terminals for extracting and displaying data from the data bases provides a fast and responsive method for obtaining needed information. The system consists of general purpose computer programs that provide the overall capabilities of the total system. The system can process any number of data files via a Dictionary (one for each file) which describes the data format to the system. New files may be added to the system at any time, and reprogramming is not required. Illustrations of the system are shown, and sample inquiries and responses are given. Author

N76-15910# Transportation Data Coordinating Committee, Washington, D.C.
PRELIMINARY FUNCTIONAL SPECIFICATION FOR A PROTOTYPE ELECTRONIC DATA INTERCHANGE SYSTEM, PHASE 1 Final Report, 14 Jan. - 14 Jul. 1975
Joseph G. Carley, Jr., Ralph W. Notto, Earl J. Bass, Lester A. Probst, and E. A. Guilbert Jul. 1975 439 p refs
(Contract DOT-OS-50017)
(PB-244092/3; TDCC-75-201; DOT-OS-50017-1) Avail: NTIS HC $11.75 CSCL 05C

A preliminary specification is presented for electronic data interchange of transportation information between shippers, carriers, forwarders and banks. This specification was prepared in conjunction with working groups from transportation industry participants. GRA

N76-15911# Applied Communication Research, Inc., Stanford, Calif.
INNOVATION IN DISSEMINATION OF SCIENTIFIC AND TECHNICAL INFORMATION
Richard H. Miller, Janice M. Bliel, and James W. Corcoran Apr.

1975 402 p refs
(Contract NSF C-951)
(PB-244333/1) Avail: NTIS HC $11.00 CSCL 05B

The planning guide endeavors to bring together under one cover an introduction to each of the many multi-disciplinary procedural tools and technological innovations applicable to Scientific and Technical Information communications, with discussions of their STI-specific applications. It is designed to help the reader make an informed first step toward choosing and implementing such innovations. In order not to waste time with what the reader already knows the planning guide is organized for reader-controlled access to its information. GRA

N76-15912# National Bureau of Standards, Washington, D.C.
A FILE MANAGEMENT SYSTEM FOR A LABORATORY AUTOMATION FACILITY Final Report
Peter S. Shoenfield and Lawrence J. Kaetzel Jun. 1975 55 p refs
(COM-75-11134/4; NBSIR-75-713) Avail: NTIS HC $4.50 CSCL 14B

A centralized laboratory automation facility built around a multiprogrammed minicomputer is described. A file manager was developed which allows the dynamic creation and manipulation of sequention of disk file. Although the system was developed for real-time data acquisition, it is a general purpose addition to the computer's operating system and may be used for a variety of applications. An operating system function was developed to allow the queued scheduling of programs. This is used to achieve more efficient multiprogramming. A comprehensive file utility package is also provided. GRA

N76-15913# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
THE PREPARATION OF TECHNICAL PUBLICATIONS Reference Publication
Jerry J. Becker Mar. 1975 38 p
(AD-A014417; DMAAC-Ref-Pub-75-002) Avail: NTIS CSCL 05/2

Most writers of technical publications within the Defense Mapping Agency Aerospace Center (DMAAC) are scientists in the fields relating to mapping, charting, and geodesy. Their forte is in their respective field and relies on technical publications such as this one to assist them in putting their scientific notations in a well organized, standard format. This technical publication was developed to provide the standard steps used by a technical writer in developing one of several types of technical publications such as papers, reports presentations, or articles. Helpful hints are given on the preparation of the information, the illustration of technical information, and the journalistic jargon used by the editor. Technical writing is not a specific function of the scientists at DMAAC. Technical publications are normally a result of the need to communicate with their peer scientists, therefore, this reference publication was developed expressly for the DMAAC scientists and patterned to meet the requirements of DMAAC Regulations and Instructions, but in concert with American National Standard Institute on scientific and technical reports.
Author (GRA)

N76-15073* Southern California Aviation Council, Inc., Pasadena.
LTA BIBLIOGRAPHY
Richard D. Neumann *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 685-688 refs (For availability see N76-15015 06-01)
CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-15914*# Aerospace Corp., El Segundo, Calif.
SHUTTLE USER ANALYSIS (STUDY 2.2). VOLUME 3: BUSINESS RISK AND VALUE OF OPERATIONS IN SPACE (BRAVO). PART 5: ANALYSIS OF GSFC EARTH OBSERVATION SATELLITE (EOS) SYSTEM MISSION MODEL USING BRAVO TECHNIQUES
28 Feb. 1975 57 p refs
(Contract NASw-2575)
(NASA-CR-146086; ATR-74(7342)-1-Vol-3-Pt-5) Avail: NTIS HC $4.50 CSCL 05C

Cost comparisons were made between three modes of operation (expend, ground refurbish, and space resupply) for the Earth Observation System (EOS-B) to furnish data to NASA on alternative ways to use the shuttle/EOS. Results of the analysis are presented in tabular form. Author

N76-15915# Massachusetts Inst. of Tech., Cambridge.
MULTIREGIONAL ECONOMIC IMPACTS OF ENERGY AND TRANSPORTATION POLICIES
Karen R. Polenske and Paul F. Levy Mar. 1975 128 p refs
(Contract DOT-OS-30104)
(PB-244586/4; Rept-8) Avail: NTIS HC $6.00 CSCL 05C

The report presents a multiregional empirical analysis of energy and transportation. The study shows how the multiregional input-output (MRID) model for the United States can be used to analyze energy and transportation policies in general. A specific study deals with the economic interaction between electricity, coal, and freight transportation created by changes in the regional technologies of generating electricity as well as alterations in the interregional shipments of coal. Recommendations are given for extending the MRIO data base and modifying the MJRIO model to increase its usefulness for the study of energy and transportation at the regional level. GRA

N76-15916# Naval Postgraduate School, Monterey, Calif.
DESIGN TO COST: CONCEPT AND APPLICATION M.S. Thesis
Noel Paul Horn and Peter Vincent Dabbieri, Jr. Dec. 1974 135 p refs
(AD-A004233) Avail: NTIS CSCL 15/5

Design-to-cost has been instituted as one of the several reforms to Department of Defense procurement practices. This thesis presents historical needs for such reforms. Design-to-cost is described and placed in context with other policy revisions. Impacts of recent changes and resultant controversies are explored. Sample cases display the actual implementation of design-to-cost. Problem areas are enumerated and remedial actions proposed.
Author (GRA)

N76-15917# Directorate of Aerospace Studies, Kirtland AFB, N. Mex.
HANDBOOK FOR THE IMPLEMENTATION OF THE DESIGN TO COST CONCEPT Final Report
Richard H. Anderson and Thomas E. Dixon Feb. 1975 106 p refs
(AD-A013802; SA-TR-75-2) Avail: NTIS CSCL 15/5

This report documents various models and methodologies in the form of a practical handbook of management tools. These management tools provide a system Program Manager with the means to do the following on a day-by-day basis: (1) Evaluate current system progress; (2) Identify problem areas associated with various subsystems where corrective actions or additional subsystem options are required; (3) Identify subsystems for which a reduction in performance has a small effect on total system performance and investigate if these subsystems can be replaced by lower cost subsystems with the cost savings invested more effectively in the improvement of other more critical subsystems; (4) Select the combination of subsystem options yielding the maximum total system performance achievable at the Design to Cost goal, i.e., optimal allocation of resources; and (5) Evaluate the effect of any proposed change in system design and its impact on Design to Cost goals. GRA

N76-15918# General Research Corp., Santa Barbara, Calif.
COST ESTIMATING STUDY, AN ABSTRACT OF ACTIVITIES PERFORMED IN 1974 Technical Report, 1 Jan. - 31 Dec. 1974
W. D. Flueckiger Feb. 1975 7 p refs
(Contract N00014-72-C-0311)
(AD-A014349; CR-1-519) Avail: NTIS CSCL 14/1

This report summarizes the cost estimating/cost analysis activities performed for the Office of the Chief of Naval Operations, Systems Analysis Division, Resource Analysis Group. Cost

estimating and analysis were provided for Navy tactical missiles and tactical data processing hardware and software. GRA

N76-15919# Naval Postgraduate School, Monterey, Calif.
A REVENUE AND EXPENSE APPORTIONMENT CONCEPT FOR THE ANALYSIS OF INTERNAL RETURNS ON INVESTMENT: THE SIMPLE CASE
James P. Hynes Apr. 1975 82 p refs
(AD-A014559; NPS-55HJ75041) Avail: NTIS CSCL 05/3

This paper presents a technique which uses revenue, expense, and investment data to assign returns on investment to each activity in an interactive economic system. It is a simple case of a more general model. The economic system may be a group of firms, a single firm, or a part of a firm. The technique, referred to here as revenue and expense apportionment, is particularly suited for joint cost and joint product situations such as those encountered in transportation, petrochemical production, and industrial funded activities in the Government. The principal theme of the apportionment concept is that revenues and expenses can be logically distributed among activities by using a transfer pricing mechanism so as to reveal how each segment shares in a system's overall return on investment, even when joint products are involved. The apportionment concept assigns returns to the activities involved in creating products and services; this is in contrast to approaches that distribute revenues and expenses directly to products and services. The apportionment concept is also linked to profit maximization concepts when the model of the system meets some fundamental requirements. The managerial and economic applications of the apportionment methodology include segmental investment evaluation, limited segmental performance analyses, pricing analyses and regulation. Included in this paper is a brief discussion of existing approaches, a description of the way in which a system is to be modelled in order to apply the apportionment technique, a discussion of apportionment concepts, their interpretation, numerical examples, and some economic implications. Author (GRA)

N76-15920# Mantech of New Jersey, Rockville, Md.
EXECUTIVE SUMMARY OF THE NAVY WEAPON SYSTEM LIFE-CYCLE COST MODEL (WSCOM)
Stephen S. Wood Jul. 1975 9 p refs Sponsored by Navy
(AD-A014319; P-7509) Avail: NTIS CSCL 15/5

The Navy Weapon System Life-Cycle Cost Model is a generalized user-oriented cost model that calculates and displays system costs in accordance with a Work Breakdown Structure (WBS) or similar hierarchal cost level scheme. It is applicable to any development program in which costs must be monitored and recalculated for frequent changes in cost-related parameters. The model is intended for use by a cost analyst. GRA

N76-15921# Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio.
PROCEEDINGS OF THE LIFE CYCLE COST TASK GROUP OF THE JOINT SERVICES DATA EXCHANGE FOR INERTIAL SYSTEMS Final Report
Russell B. Stauffer 21 Nov. 1974 88 p Presented at the 5th Quarterly Meeting, Redondo Beach, Calif., 19 Nov. 1974
(AD-A014108; AGMC-74-046) Avail: NTIS CSCL 17/7

These proceedings describe the activities of the fifth quarterly meeting of the Life Cycle Cost Task Group of the Joint Services Data Exchange for Inertial Systems held 19-21 November 1974. The proceedings contain the text and slides (where available) of the invited papers and the results of sub group meetings on charter revisions, creation of LCC Task Group descriptive paper and preparation of input/output specifications for the LCC model under development. GRA

N76-15016* Massachusetts Inst. of Tech., Cambridge.
BASIC RELATIONSHIPS FOR LTA ECONOMIC ANALYSIS
Raymond A. Ausrotas *In its* Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 1-6 refs (For availability see N76-15015 06-01)
CSCL 05C

N76-15017* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY ESTIMATES OF OPERATING COSTS FOR LIGHTER THAN AIR TRANSPORTS
C. L. Smith and M. D. Ardema *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 7-19 refs (For availability see N76-15015 06-01)
CSCL 05C

N76-15018* Holland America Line, Rotterdam (Netherlands).
COMPARATIVE AIRSHIP ECONOMICS
Robert Harthoorn *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 21-30 refs (For availability see N76-15015 06-01)
CSCL 05C

N76-15020* Southern California Aviation Council, Inc., Pasadena.
AIRSHIP ECONOMICS
Richard D. Neumann and L. R. Mike Hackney *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 41-52 refs (For availability see N76-15015 06-01)
CSCL 05C

N76-15021* Southern California Aviation Council, Inc., Pasadena.
SOME ECONOMIC TABLES FOR AIRSHIPS
Richard D. Neumann *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 53-61 (For availability see N76-15015 06-01)
CSCL 05C

N76-15023* Naval Academy, Annapolis, Md.
AN ECONOMIC COMPARISON OF THREE HEAVY LIFT AIRBORNE SYSTEMS
Bernard H. Carson *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 75-85 refs (For availability see N76-15015 06-01)
CSCL 05C

N76-15024* Massachusetts Inst. of Tech., Cambridge.
AN APPROACH TO MARKET ANALYSIS FOR LIGHTER THAN AIR TRANSPORTATION OF FREIGHT
Paul O. Roberts, Henry S. Marcus, and Jean H. Pollock (Babson Coll., Babson Park, Mass.) *In its* Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 87-110 refs (For availability see N76-15015 06-01)
CSCL 05C

N76-15025* Aerospace Developments, London (England).
MARKET ASSESSMENT IN CONNECTION WITH LIGHTER THAN AIR
John E. R. Wood *In* MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles Jan. 1975 p 111-121 (For availability see N76-15015 06-01)
CSCL 05C

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-15922# Committee on Science and Technology (U. S. House).
AN ANALYSIS IDENTIFYING ISSUES IN THE FISCAL YEAR 1976 ERDA BUDGET
Washington GPO Mar. 1975 102 p Rept. prepared for Comm. on Sci. and Technol., Comm. on Interior and Insular Affairs, and Joint Comm. on Atomic Energy, 94th Congr., 1st Sess., Mar. 1975
(GPO-48-010) Avail: SOD HC $1.25

Fiscal budgets for research projects in energy technology are presented. Various energy sources are discussed such as: (1) nuclear energy (power plants), (2) fossil fuels (coal, oil, and gas), (3) solar energy, (4) magnetohydrodynamics, and (5) waste energy utilization. Government and private industry capabilities are examined for developing the above energy sources to meet the Nations's energy needs. J.R.T.

N76-15923# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER

INDEPENDENT AGENCIES APPROPRIATIONS, FISCAL YEAR 1975, PART 1
Washington GPO 1974 848 p refs Hearings on H.R. 15572 before a subcomm. of Comm. on Appropriations, 93d Congr., 2d Sess., 11 Jan. 1974
(GPO-27-909-Pt-1) Avail: Comm. on Appropriations

Monetary priorities for programs of various agencies in the Federal Government are examined. Emphasized and outlined are research budgets for Space Programs. Topics discussed are: (1) Equal Employment Opportunity of NASA and NASA contractors, (2) housing and bank loans, (3) the Communications Industry (recent Supreme Court decisions on fees in television, radio, telephone systems), and (4) Veteran's benefits (in education, medical, and employment). J.R.T.

N76-15924# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATIONS, FISCAL YEAR 1975, PART 2
Washington GPO 1974 658 p refs Hearings on H.R. 15572 before a subcomm. of Comm. on Appropriations, 93d Congr., 2d Sess., 22 Apr. 1974
(GPO-27-909-Pt-2)

For abstract, see N76-15923.

N76-15925# Committee on Interior and Insular Affairs (U. S. Senate).
ECONOMIC IMPACT OF PRESIDENT FORD'S ENERGY PROGRAM
Washington GPO 1975 864 p refs Hearings pursuant to S. Res. 45 before Comm. on Interior and Insular Affairs, 94th Congr., 1st Sess., 31 Jan. and 12 Feb. 1975
(GPO-48-736) Avail: Comm. on Interior and Insular Affairs

A discussion is presented of the proposal to try and reduce energy consumption by imposing import tariffs and excises taxes and decontrolling oil prices. The basis for the selection of prohibitive pricing as the principal means of energy conservation in the program was studied. Topics discussed include current energy problems, oil prices, petroleum imports, import controls, gasoline rationing, economic supply and demand for petroleum products, inflation impact, international energy policy, and energy consumption. M.J.S.

N76-15926# Committee on Appropriations (U. S. Senate).
THE BUDGET OF THE UNITED STATES GOVERNMENT, FISCAL YEAR 1976
Washington GPO 1975 104 p Hearings before Comm. on Appropriations, 94th Congr., 1st Sess., 13 Feb. 1975
(GPO-47-270) Avail: Comm. on Appropriations

A discussion of the economic state of the United States is presented. Federal Government budgets are examined and priority areas are established. Some of the topics discussed are: (1) inflation and recession; (2) tax cuts to stimulate the economy; (3) corporate profits; (4) housing goals and urban development, (5) energy crisis and foreign oil; and (6) tariffs. J.R.T.

N76-15927# Committee on Appropriations (U. S. Senate).
SECOND SUPPLEMENTAL APPROPRIATIONS, FISCAL YEAR 1975, PART 2
Washington GPO 1975 823 p refs Hearings on H.R. 5899 before subcommittees of Comm. on Appropriations, 94th Congr., 1st Sess., 20 Mar. 1975
(GPO-49-100) Avail: Comm. on Appropriations

Requests and justifications are presented for supplemental appropriations in the following areas: commerce, agriculture, defense, labor, transportation, equal employment, energy policy, water quality, rail transportation, technology assessment, legal activities, foreign affairs, and District of Columbia budgets. M.J.S.

N76-15928# Committee on Interior and Insular Affairs (U. S. Senate).
OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS AND COASTAL ZONE MANAGEMENT ACT AMENDMENTS, PART 2
Washington GPO 1975 1069 p refs Joint hearings pursuant to S. Res. 45 and S. Res. 222 before Comm. on Interior and Insular Affairs and Commerce, 94th Congr., 1st Sess., 8-9 Apr. 1975
(GPO-51-748) Avail: Comm. on Interior and Insular Affairs

The leasing procedures of Federal offshore lands and possible changes to those procedures are discussed in detail. Topics reviewed and investigated include offshore oil and gas resources, oil prices, increased competition in the petroleum industry, exploration and development of the outer continental shelf, legislation dealing with offshore development, financial management of offshore development, constraints to expanded production, and a national energy policy. The coastal zone management act is considered which authorizes and assists the coastal states in studying, planning for, managing, and controlling the impact of energy resource development and production on coastal zones. M.J.S.

N76-15929# Committee on Commerce (U. S. Senate).
THE THIRD UN LAW OF THE SEA CONFERENCE
Herman T. Franssen, Marjorie Ann Browne, and James E. Mielke Washington GPO 1975 70 p refs Rept. pursuant to S. Res. 222, 94th Congr., 1st Sess., 21 Apr. 1975 Prepared by the Library of Congr., Congressional Res. Service
(GPO-49-376) Avail: SOD HC $0.85

A review of international maritime legislation is presented. The definition of a continental shelf, and legal liabilities in fishing rights of nations are examined. Pollution of the oceans and conservation of marine resources is discussed. J.R.T.

N76-15930# Energy and Environmental Analysis, Inc., Arlington, Va.
THE WATER POLLUTION CONTROL ACT OF 1972: INSTITUTIONAL ASSESSMENT, THE PERMIT PROGRAM Final Report
Aug. 1975 401 p refs
(Contract WQ5AC041)
(PB-244805/8; NCWQ-75/09) Avail: NTIS HC $11.00 CSCL 13B

The permit programs administration is described as successful on achieving compliance by industry but a failure as applied to municipal dischargers; permits to municipalities so far issued can fairly be described as 'licenses to pollute'. Eighty percent of industrial dischargers surveyed indicated that they would install 'best practicable control technology' and additionally required technology by July 1, 1977, but it is felt that industry will contest upcoming 1983 standards for best available treatment, toxic standards and pre-treatment standards. Federal-State relations in administering the program were found to be strained and awkward at the beginning but are said to be now improving. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N76-15931*# George Washington Univ., Washington, D.C. Program of Policy Studies in Science and Technology.
READINGS IN TECHNOLOGY ASSESSMENT
Aug. 1975 792 p refs
(Grant NGL-09-010-030)
(NASA-CR-145988) Avail: NTIS HC $18.75 CSCL 05H

Papers are presented which reflect research in the following areas: development of the concept of technology assessment; institutionalization of technology assessment; the interface between law and technology assessment; and assessment case studies. Case studies include hazards of the medical use of X-rays, environmental noise effects in transportation planning, genetic technology, impact of underground coal mining, and aircraft/airport noise abatement. For individual titles, see N76-15932 through N76-15956.

N76-15932* George Washington Univ., Washington, D.C.
HISTORICAL ASPECTS OF TECHNOLOGY ASSESSMENT
Melvin Kranzberg *In its* Readings in Technology Assessment Aug. 1975 21 p (For availability see N76-15931 06-85)
CSCL 05H

The historical developments which have brought about changes in the way technology is viewed are discussed. These include: (1) the broadening through the centuries of the social context for technological change and assessment; (2) the growing need since the Industrial Revolution for assessment; (3) the recent deepening awareness of the impacts of technology; (4) the development of social and communal responsibility for technology, and (5) the current growth in the assessment capability. Author

N76-15933* George Washington Univ., Washington, D.C.
TECHNOLOGY AND PUBLIC POLICY: THE PROCESS OF TECHNOLOGY ASSESSMENT IN THE FEDERAL GOVERNMENT
Vary T. Coates *In its* Readings in Technology Assessment Aug. 1975 36 p refs (For availability see N76-15931 06-85)
CSCL 05H

A study was conducted to provide a descriptive and analytical review of the concept of technology assessment and the current status of its applications in the work of the federal executive agencies. The origin of the term technology assessment was examined along with a brief history of its discussion and development since 1966 and some of the factors influencing that development. Author

N76-15934* George Washington Univ., Washington, D.C.
CONTEXTUAL APPROACH TO TECHNOLOGY ASSESSMENT: IMPLICATIONS FOR ONE-FACTOR FIX SOLUTIONS TO COMPLEX SOCIAL PROBLEMS
Louis H. Mayo *In its* Readings in Technology Assessment Aug. 1975 69 p refs (For availability see N76-15931 06-85)
CSCL 05H

The contextual approach is discussed which undertakes to demonstrate that technology assessment assists in the identification of the full range of implications of taking a particular action and facilitates the consideration of alternative means by which the total affected social problem context might be changed by available project options. It is found that the social impacts of an application on participants, institutions, processes, and social interests, and the accompanying interactions may not only induce modifications in the problem contest delineated for examination with respect to the design, operations, regulation, and use of the posited application, but also affect related social problem contexts. M.J.S.

N76-15935* George Washington Univ., Washington, D.C.
TECHNOLOGY ASSESSMENT: WHAT SHOULD IT BE?
Guy Black *In its* Readings in Technology Assessment Aug. 1975 11 p refs (For availability see N76-15931 06-85)
CSCL 05H

The necessity of uncovering unsuspected relationships in proposed actions is discussed along with the feasibility of using decision theoretical models to cope with problems of uncertainty in the future-oriented analyses characteristic of assessments. It is shown that it is necessary to integrate the results of technology assessment with other program analyses and that results of technology assessment be supplied in a form that permits integration with other information. M.J.S.

N76-15936* George Washington Univ., Washington, D.C.
SOCIAL IMPACT EVALUATION: SOME IMPLICATIONS OF THE SPECIFIC DECISIONAL CONTEXT APPROACH FOR ANTICIPATORY PROJECT ASSESSMENT (ARA)
Louis H. Mayo *In its* Readings in Technology Assessment Aug. 1975 18 p (For availability see N76-15931 06-85)
CSCL 05H

An anticipatory project assessment is discussed which is characterized as the capacity to perform, and the disposition to take into account in relevant decisional areas, the following operations: identification of the significant effects which will result from the introduction of a specified project configuration into alternative projected future social environments during the planning, implementation, and operational states; evaluation of such effects in terms of social impacts on affected participants and social value-institutional processes in accord with specified concepts of social justice. Author

N76-15937* George Washington Univ., Washington, D.C.
GENERATING SOCIAL IMPACT SCENARIOS: A KEY STEP IN MAKING TECHNOLOGY ASSESSMENT STUDIES
Martin V. Jones *In its* Readings in Technology Assessment Aug. 1975 20 p refs (For availability see N76-15931 06-85)
CSCL 05H

The MITRE methodological studies were conducted to define relevant questions in relation to the concept of total impact analysis and to provide a procedure for integrating diverse checklists of questions which trace the initial and secondary impacts of any major technological application or of society's attempts to respond to or redirect that application. Some of the results of that study are presented in tabular form. M.J.S.

N76-15938* George Washington Univ., Washington, D.C.
PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION FOR A RETROSPECTIVE TECHNOLOGY ASSESSMENT OF SUBMARINE TELEGRAPHY
Vary T. Coates and Bernard S. Finn *In its* Readings in Technology Assessment Aug. 1975 9 p (For availability see N76-15931 06-85)
CSCL 05H

The conceptual and methodological importance of doing retrospective technology assessments is summarized. The rationale for the study of submarine telegraphy is briefly summarized along with the study plan, the management plan, and dissemination and utilization of the results. M.J.S.

N76-15939* George Washington Univ., Washington, D.C.
SOME LEGAL, JURISDICTIONAL, AND OPERATIONAL IMPLICATIONS OF A CONGRESSIONAL TECHNOLOGY ASSESSMENT COMPONENT
Louis H. Mayo *In its* Readings in Technology Assessment Aug. 1975 54 p (For availability see N76-15931 06-85)

An analysis is presented for the Congress of the relationships between an institutionalized assessment function and legislative information gathering and decisionmaking needs. The study was directed to the following topics: (1) the positing of a hypothetical technology assessment component for legislative support; (2) the posing of a number of questions relating to the operational context of this assessment component including the organization/operational framework, general operational problems, access to relevant information, and the utilization of assessment data and analyses; and (3) some selected comments relevant to the questions posed. M.J.S.

N76-15940* George Washington Univ., Washington, D.C.
SOME IMPLICATIONS OF THE TECHNOLOGY ASSESSMENT FUNCTION FOR THE EFFECTIVE PUBLIC DECISION MAKING PROCESS
Louis H. Mayo *In its* Readings in Technology Assessment Aug. 1975 7 p (For availability see N76-15931 06-85)
CSCL 05H

A study was undertaken to analyze ways in which the institutionalization of the assessment function can affect the following phases of the public decision process: problem perception, problem definition, data assembly, invention of alternatives, evaluation of options, authorization, implementation, operation, appraisal, and modification. Author

N76-15941* George Washington Univ., Washington, D.C.
IMPLEMENTING TECHNOLOGY ASSESSMENTS
Raphael G. Kasper, ed., John M. Logsdon, ed., and Ellis R. Mottur, ed. *In its* Readings in Technology Assessment Aug. 1975 60 p refs (For availability see N76-15931 06-85)
CSCL 05H

Five case studies of specific technology assessments and the ways in which they influenced (or did not influence) the development of the assessed technology are discussed. Automotive air pollution and problems of implementing technology assessment are considered. The assessment-acceptance-implementation process is discussed in detail using the five case studies as examples. M.J.S.

N76-15942* George Washington Univ., Washington, D.C.
TECHNOLOGY AND PUBLIC POLICY: THE PROCESS OF TECHNOLOGY ASSESSMENT IN THE FEDERAL GOVERNMENT
Vary T. Coates *In its* Readings in Technology Assessment Aug. 1975 48 p (For availability see N76-15931 06-85)
CSCL 05H

Conclusions drawn from research and a series of recommendations for the improvement of the technology assessment process in Federal agencies are presented. The following topics are discussed: (1) who is doing technology assessment; (2) the organization of technology assessments; (3) disciplines and techniques used in technology; (4) analysis of a sample of technology assessment studies: initiation, disciplines, techniques, costs, scope, purpose, and utilization; (5) gaps and overlaps in governmental assessment of nine major technologies; (6) prerequisites for further improvement of technology assessment; and (7) recommendations. Author

N76-15943* George Washington Univ., Washington, D.C.
CANDIDATES AND PRIORITIES FOR TECHNOLOGY ASSESSMENTS: A SURVEY OF FEDERAL EXECUTIVE AGENCY PROFESSIONALS
Howard C. Reese *In its* Readings in Technology Assessment Aug. 1975 18 p (For availability see N76-15931 06-85)
CSCL 05H

A survey was conducted to provide a list of candidates for technology assessment for the purpose of assisting NSF in its role of supporting planning and assessment activities in and out of government. The study was to result in: a list of subjects which survey participants suggested needed technology assessment together with an indication of the frequency of each subject mentioned; suggested criteria for categorization of subjects for assessment; preliminary evaluation of the urgency and of the significance of each candidate based on responses obtained by the survey; and levels of government and agency location for recommended technology assessments. Author

N76-15944* George Washington Univ., Washington, D.C.
SOUTHERN REGIONAL WORKSHOP ON TECHNOLOGY ASSESSMENT
Vary T. Coates and John E. Mock *In its* Readings in Technology Assessment Aug. 1975 14 p (For availability see N76-15931 06-85)
CSCL 05H

A conference was conducted to provide information about, and training in, technology assessment for those who formulate policy and make critical decisions about technological programs and projects at the state and community levels, where the impacts of technological programs and projects at the state and community levels, where the impacts of technological development are most directly felt. Results and highlights of the conference are summarized. Author

N76-15945* George Washington Univ., Washington, D.C.
EMERGING TRENDS IN TECHNOLOGY ASSESSMENT
Vary T. Coates *In its* Readings in Technology Assessment Aug. 1975 19 p refs (For availability see N76-15931 06-85)
CSCL 05H

Recent trends and problems in technology assessment are discussed briefly. The Congressional Office of Technology Assessment and its performance are reviewed along with technology assessment activity in the National Science Foundation. M.J.S.

N76-15946* George Washington Univ., Washington, D.C.
TECHNOLOGY ASSESSMENT AND CITIZEN ACTION
Ellis R. Mottur *In its* Readings in Technology Assessment Aug. 1975 18 p (For availability see N76-15931 06-85)
CSCL 05H

Citizen participation in the nation's total social, political, economic decisionmaking processes was studied. Impediments are discussed which prevent citizens from taking effective assessment action; these include finance, organization and motivation, and information. The proposal for establishing citizens assessment associations is considered along with implications of citizen assessment action. M.J.S.

N76-15947* George Washington Univ., Washington, D.C.
EVALUATION OF OAK RIDGE NATIONAL LABORATORY REPORT ON TECHNOLOGY ASSESSMENT OF MODULAR INTEGRATED UTILITY SYSTEMS (MIUS)
Louis H. Maxo *In its* Readings in Technology Assessment Aug. 1975 26 p refs (For availability see N76-15931 06-85)
CSCL 05H

The evaluation indicates the need to establish professional standards for judging the adequacy with which assessments are performed and for analyzing the sufficiency of the definition of task-objectives that are given to or posited by assessment entities. Three basic performance criteria are posited: interpretability, warrantability, and serviceability of utility of assessment outcome to the relevant decisional entity or entities. M.J.S.

N76-15948* George Washington Univ., Washington, D.C.
SCIENTIFIC METHOD, ADVERSARIAL SYSTEM, AND TECHNOLOGY ASSESSMENT
Louis H. Mayo *In its* Readings in Technology Assessment Aug. 1975 48 p refs (For availability see N76-15931 06-85)
CSCL 05H

A basic framework is provided for the consideration of the purposes and techniques of scientific method and adversarial systems. Similarities and differences in these two techniques of inquiry are considered with reference to their relevance in the performance of assessments. Author

N76-15949* George Washington Univ., Washington, D.C.
ADVOCACY AND TECHNOLOGY ASSESSMENT
Ernest M. Jones *In its* Readings in Technology Assessment Aug. 1975 27 p refs (For availability see N76-15931 06-85)
CSCL 05H

A highly structured treatment is presented of adversarial systems as they apply to technology assessment. One approach to the problem of adequate criteria of assessment focuses upon the internal operations of assessment entities; operations include problem perception, problem formulation, selection, utilization, determination, and evaluation. Potential contributions of advocacy as a mode of inquiry in technology are discussed; advocacy is evaluated by representative sets of criteria of adequate assessment which include participant criteria, perspectives criteria, situations criteria, base values criteria, and strategies criteria. M.J.S.

N76-15950* George Washington Univ., Washington, D.C.
LAW'S INTERFACE WITH EXPANDING TECHNOLOGY
Harold P. Green *In its* Readings in Technology Assessment Aug. 1975 11 p (For availability see N76-15931 06-85)
CSCL 05H

The interaction of technology assessments with the process of political decisionmaking is discussed. Reasons are suggested as to why those engaged in the assessment function should not be optimistic of the impacts of assessment outcomes on political decisionmaking. Author

N76-15951* George Washington Univ., Washington, D.C.
EARLY EXPERIENCES WITH THE HAZARDS OF MEDICAL USE OF X-RAYS, 1896-1906
Barbara S. Marx *In its* Readings in Technology Assessment Aug. 1975 11 p (For availability see N76-15931 06-85)
CSCL 05H

The characteristics of the technology assessment process are discussed which were manifested in response to the hazardous effects of early medical uses of X-rays. A model is proposed which describes the early stages of the technology assessment process; the stages include identification, assessment, and control. M.J.S.

N76-15952* George Washington Univ., Washington, D.C.
CONTROLLING THE POTENTIAL HAZARDS OF GOVERNMENT-SPONSORED TECHNOLOGY
Michael J. Wollan *In its* Readings in Technology Assessment Aug. 1975 33 p refs (For availability see N76-15931 06-85)
CSCL 05H

The ability was examined of governmental agencies to adequately assess technological programs or projects to which they are committed. The hazards of government-sponsored activities are discussed; these include weather modification,

supersonic transport noise, and the value conflicts involved in the fluoridation controversy. These three case studies indicate that the Federal vested interests in the continuation of its technological programs limit its ability to provide adequate technology assessment. Author

N76-15953* George Washington Univ., Washington, D.C.
CONSIDERATION OF ENVIRONMENTAL NOISE EFFECTS IN TRANSPORTATION PLANNING BY GOVERNMENTAL ENTITIES
Louis H. Mayo *In its* Readings in Technology Assessment Aug. 1975 53 p (For availability see N76-15931 06-85)
CSCL 05H

Environmental concerns are reviewed with respect to major transportation systems: the interstate highway system and commercial air transportation. The type of planning that was done for interstate highway systems is described, and the shift in social value emphasis that has become apparent since the interstate system was authorized is considered. Other topics discussed include the constitutional framework for the allocation of governmental power with respect to transportation systems planning, governmental assessment of the aircraft noise problem, and evaluating the social benefit of noise abatement. M.J.S.

N76-15954* George Washington Univ., Washington, D.C.
GENETIC TECHNOLOGY: PROMISES AND PROBLEMS
Mark S. Frankel *In its* Readings in Technology Assessment Aug. 1975 72 p refs (For availability see N76-15931 06-85)
CSCL 05H

Issues concerning the use of genetic technology are discussed. Some areas discussed include treating genetic disease, prenatal diagnosis and selective abortion, screening for genetic disease, and genetic counseling. Policy issues stemming from these capabilities are considered. M.J.S.

N76-15955* George Washington Univ., Washington, D.C.
COMMUNITY LEVEL IMPACTS OF EXPANDING UNDERGROUND COAL MINING
Vary T. Coates *In its* Readings in Technology Assessment Aug. 1975 35 p refs (For availability see N76-15931 06-85)
CSCL 05H

The potential secondary consequences of rapid community growth in deep mining localities and the ability of affected communities to absorb and manage such growth are discussed. Areas discussed include Sweetwater County, Wyoming, and Marion and Monongalia Counties, West Virginia. M.J.S.

N76-15956* George Washington Univ., Washington, D.C.
AN INTEGRATED STRATEGY FOR AIRCRAFT/AIRPORT NOISE ABATEMENT: A LEGAL-INSTITUTIONAL CONTROL ACT SECTION 7 TO THE NOISE CONTROL ACT OF 1972 AND PROPOSALS BASED THEREON
Louis H. Mayo *In its* Readings in Technology Assessment Aug. 1975 8 p (For availability see N76-15931 06-85)
CSCL 05H

The development of the aircraft noise control structure since the Griggs case of 1962 was examined. The Noise Control Act of 1972 is described which undertook to establish the legal-institutional framework within which an adequate aircraft/airport noise abatement program might be initiated with concern for full recognition of all the beneficial and detrimental consequences of air transportation and appropriate distribution of benefits and costs. Author

N76-15957# Naval Postgraduate School, Monterey, Calif.
AN URBAN TRANSPORTATION MODEL M.S. Thesis
Robert William Sagehorn Jun. 1975 52 p refs
(AD-A012462) Avail: NTIS CSCL 15/5

A proposal for a personalized urban transportation system model for a community of 250,000 population or less. The model utilizes existing modes and provides increased servicing at minimal cost while lessening the impact of travel on the environment and use of resources. Some areas for future research are also suggested. Author (GRA)

N76-15958# Office of Technology Assessment, Washington, D.C.
[OFFICE OF TECHNOLOGY ASSESSMENT PROJECTS IN OCEANS, TRANSPORTATION, ENERGY, MATERIALS, FOOD AND HEALTH] Annual Report
15 Mar. 1975 70 p refs
(PB-244833/0) Avail: NTIS HC $4.50 CSCL 05A

The report summarizes the activities of the Office of Technology Assessment from March 15, 1974, through March 15, 1975. A brief legislative history is given as well as a description of the projects underway or projected in each of the following subject areas: (1) oceans, (2) transportation, (3) energy, (4) materials, (5) food, and (6) health. The Office of Technology Assessment was established by the Technology Assessment Act of 1972 (Public Law 92-484) to provide Congress with new effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of technological applications; and to serve as an aid in the legislative assessment of matters pending before the Congress. GRA

88 SPACE SCIENCES (GENERAL)

N76-15959# Centre National d'Etudes Spatiales, Paris (France).
FRENCH SPACE PROGRAM: REPORT TO COSPAR [PROGRAMME SPATIAL FRANCAIS. RAPPORT AU COSPAR]
1975 112 p refs In FRENCH Presented at the 18th COSPAR Assembly, Varna, Bulg., May 1975
Avail: NTIS HC $5.50

Programs and results obtained are reviewed for all French laboratories working in areas of research related to space. Main topics include lunar specimen studies; spectroscopic planetology; space radiation; ionospheric and magnetospherics; aeronomy; meteorology, comprising the Meteosat program and the Eole experiment and earth resources investigations; geodesy; and geodynamics-research covering space biology and exobiology is also discussed. French satellites and sounding rockets are listed, as well as French experiments onboard foreign spacecraft. (ESA)

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

No abstracts in this category.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-15960*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CNO ABUNDANCES AND HYDRODYNAMIC MODELS OF THE NOVA OUTBURSTS. 4: COMPARISON WITH OBSERVATIONS
Warren M. Sparks, Sumner Starrfield (Ariz. State Univ.), and James W. Truran (Ill. Univ.) Nov. 1975 29 p refs Submitted for publication
(NASA-TM-X-71027; X-671-75-301) Avail: NTIS HC $4.00 CSCL 03B

A variety of observations of novae are discussed in light of theoretical models. It is proposed that the nearly constant bolometric luminosity of FH Ser originates in the non-degenerate hydrogen-burning region at the bottom of the hydrogen-rich envelope which remains after the primary ejection. The shift of the wavelength of peak emission from the visual to shortward of the ultraviolet is caused by the decrease of the photospheric radius of the remnant envelope as the bolometric luminosity

stays nearly constant. The oscillations in the light curve of GK Per during the transition stage can be explained by a pulsation of the remnant envelope when it is the size of the Roche lobe. The CNO over-abundances in novae reported by various observers are strongly suggestive of this nova mechanism. Finally, the implications of the upper limits of C-13 and N-15 in DQ Her are discussed. Author

N76-15961# Owens Valley Radio Observatory, Pasadena, Calif.
CARBON RECOMBINATION LINE OBSERVATIONS OF THE SHARPLESS 140 REGION
G. R. Knapp, Robert L. Brown (Natl. Radio Astronomy Obs.), T. B. Kuiper (JPL), and R. K. Kakar (JPL) 1975 26 p refs
(Contract N00014-67-A-0094-0019; Grant NSF GP-30400)
(AD-A014604; Rept-1975-15) Avail: NTIS

Carbon recombination line emission has been detected at two frequencies from a dark cloud contiguous with the small HII region Sharpless 140. The observations show the dark cloud to be of unusually low temperature and to have a markedly inhomogeneous density distribution, with localized regions of high density surrounding one or more embedded stars. The carbon is probably ionized by photons both from the exciting star of S140 and from the embedded stars. The dark cloud and S140 apparently represent two stages of star formation which have occurred over a period of at least 500,000 years in adjacent regions of the same dark cloud. GRA

N76-15962# Owens Valley Radio Observatory, Pasadena, Calif.
GAS MOTIONS IN THE CENTER OF THE GALAXY NGC 253 FROM HI LINE INTERFEROMETRY
S. T. Gottesman, L. Weliachew, R. Lucas, and M. C. H. Wright 1975 18 p refs
(Contract N00014-67-A-0094-0019; Grant NSF GP-30400)
(AD-A014603; Rept-1975-14) Avail: NTIS CSCL 03/2

An interferometric study of HI 21cm line absorption against the central radio source in NGC 253 has yielded an excess of blue-shifted velocities, which is best interpreted as absorption in neutral gas moving towards the observer away from the nucleus, in confirmation of optical studies. While all molecular studies show a feature red shifted relative to the systemic velocity, the present HI study hardly shows any signal at the same velocities. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-15963 Johns Hopkins Univ., Baltimore, Md.
THE FAR ULTRAVIOLET ALBEDO OF THE MOON Ph.D. Thesis
Robert Lancaster Lucke 1975 163 p
Avail: Univ. Microfilms Order No. 76-1573

The albedo of the moon in the far ultraviolet (1200-1650 A) obtained from data taken by the Apollo 17 Ultraviolet Spectrometer Experiment is examined. The albedo values are substantially higher than most previously reported results. In addition, the moon was found to show local albedo variations from one point to another, and it is argued that these are caused by variations in surface composition. The lunar photometric function in far ultraviolet light is extensively discussed, particularly its similarities to and differences from the visible photometric function. The results of laboratory measurements of the far ultraviolet reflectance of some lunar dust samples are reported, and are found to corroborate the observations made from lunar orbit. Measurements were also made on several terrestrial rock powders. Possible compositional implications of these measurements are discussed, along with their relation to similar measurements made by other workers. Dissert. Abstr.

N76-15964*# Texas Univ., Austin. Dept. of Astronomy.
LUNAR MOTION ANALYSIS AND LASER DATA MANAGEMENT Final Report, 1 Jul. - 30 Sep. 1975
J. Derral Mulholland Jan. 1976 23 p refs
(Grant NGR-44-012-219)
(NASA-CR-145916) Avail: NTIS HC $3.50 CSCL 03B

Work completed in lunar motion analysis and laser data management during the period July 1, 1971 - September 30, 1975 was reported. In this context, analysis refers to theoretical or numerical studies involving real or potential applications of such observations to improvement of the physical model, and data management refers to the process by which observed photon events are turned into observations and are made available to potential users. The data analysis work included: (1) bringing to operational status of computer programs for the numerical integration of the lunar orbit motion and for the application of lunar laser time delays for the improvement of the parameters of the physical model, (2) program improvement and program integrity, (3) three-dimensional ephemeris, and (4) miscellaneous independent studies. The data management work included: (1) data identification, (2) observatory interfaces, and (3) data distribution. Y.J.A.

N76-15965*# Stanford Research Inst., Menlo Park, Calif.
A NEW METHODOLOGY TO INTEGRATE PLANETARY QUARANTINE REQUIREMENTS INTO MISSION PLANNING, WITH APPLICATION TO A JUPITER ORBITER Final Report
Ronald A. Howard, D. W. North, and J. P. Pezier Aug. 1975 124 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954025; SRI Proj. MSD-3685)
(NASA-CR-146072) Avail: NTIS HC $5.50 CSCL 06M

A new methodology is proposed for integrating planetary quarantine objectives into space exploration planning. This methodology is designed to remedy the major weaknesses inherent in the current formulation of planetary quarantine requirements. Application of the methodology is illustrated by a tutorial analysis of a proposed Jupiter Orbiter mission. The proposed methodology reformulates planetary quarantine planning as a sequential decision problem. Rather than concentrating on a nominal plan, all decision alternatives and possible consequences are laid out in a decision tree. Probabilities and values are associated with the outcomes, including the outcome of contamination. The process of allocating probabilities, which could not be made perfectly unambiguous and systematic, is replaced by decomposition and optimization techniques based on principles of dynamic programming. Thus, the new methodology provides logical integration of all available information and allows selection of the best strategy consistent with quarantine and other space exploration goals. Author

N76-15966*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELS OF JOVIAN DECAMETRIC RADIATION
Robert A. Smith Dec. 1975 96 p refs Submitted for publication
(NASA-TM-X-71042; X-602-75-330) Avail: NTIS HC $5.00 CSCL 03B

A critical review is presented of theoretical models of Jovian decametric radiation, with particular emphasis on the Io-modulated emission. The problem is divided into three broad aspects: (1) the mechanism coupling Io's orbital motion to the inner exosphere, (2) the consequent instability mechanism by which electromagnetic waves are amplified, and (3) the subsequent propagation of the waves in the source region and the Jovian plasmasphere. At present there exists no comprehensive theory that treats all of these aspects quantitatively within a single framework. Acceleration of particles by plasma sheaths near Io is proposed as an explanation for the coupling mechanism, while most of the properties of the emission may be explained in the context of cyclotron instability of a highly anisotropic distribution of streaming particles. Author

N76-15967*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
JUPITER: ITS INFRARED SPECTRUM FROM 10 TO 40 MICRONS
James R. Houck, David Schaack, Robert A. Reed, James Pollack,

and A. Summers Feb. 1975 12 p refs
(Grant NGR-33-010-182)
(NASA-CR-146088; CRSR-594) Avail: NTIS HC $3.50 CSCL 03B

Spectral measurements of the thermal radiation from Jupiter in the 16-40 micrometer band were analyzed under the assumption that pressure broadened H2 transitions are responsible for the bulk of the infrared opacity over most of this spectral interval. Both the vertical pressure-temperature profile and the hydrogen mixing ratio were determined. The derived value of the molecular hydrogen mixing ratio, 0.89 + or - 0.11, is consistent with the solar value, 0.86. Author

N76-15968# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
THE SATURNIAN RINGS
Hannes Alfven Sep. 1975 15 p refs
(TRITA-EPP-75-20) Avail: NTIS HC $3.50

The relative importance of cosmogonic processes and resonance effects on the Saturn rings are analyzed in the light of current observational and theoretical results. A comparison is made with the asteroid belt, and Kirkwood gaps in the ring system are considered. The main A, B, C and D ring features identified, and a possible resonance effect with the axial rotation of Saturn is examined. The brightness of the A and B rings is analyzed. ESA

N76-15969# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
REVISED PIONEER 10 ABSOLUTE ELECTRON INTENSITIES IN THE INNER JOVIAN MAGNETOSPHERE Progress Report
D. N. Baker and J. A. VanAllen Aug. 1975 34 p refs
(Contract N00014-68-A-0196-0009)
(AD-A014607; U-of-Iowa-75-28) Avail: NTIS CSCL 03/2

Using improved techniques for the analysis of the University of Iowa Pioneer 10 Jupiter encounter data, it has been possible to obtain what are believed to be significantly more reliable values for energetic electron (E sub e - 21 MeV) intensities within 10 Jovian radii of the planet. The nature of the revisions is such that the absolute intensity values for electrons 0.06 - E sub e - 21 MeV are reduced by factors as great as 10 from previous estimates made for the University of Iowa data at L - 6. Previously published intensities at greater radial distances for E sub e - 21 MeV and at all radial distances for E sub E = 21 MeV are not affected by the revisions. GRA

N76-15970# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
RECIRCULATION OF ENERGETIC PARTICLES IN JUPITER'S MAGNETOSPHERE
D. D. Sentman and J. A. VanAllen Aug. 1975 23 p refs
(Contract N00014-68-A-0196-0009)
(AD-A014211; U-of-Iowa-75-27) Avail: NTIS CSCL 03/2

Angular distribution studies based on the low latitude Pioneer 10 data and a confirmatory analysis of Pioneer 11 data show that there exists a region in the near equatorial Jovian magnetosphere within which energetic electrons form strongly field aligned and bisymmetric pitch angle distributions; ('dumbbell' distributions). This region encompasses the transition zone between the dipolar inner magnetosphere and the highly distended magnetodisc. The angular distributions of energetic protons in this same region are approximately isotropic. The existence of a significant asymmetry in the field aligned component of the particle distributions in the high latitude regions of this L-space is discussed. GRA

N76-15971*# Geological Survey, Flagstaff, Ariz. Branch of Astrogeology.
APOLLO 17 VOICE TRANSCRIPT PERTAINING TO THE GEOLOGY OF THE LANDING SITE Final Report
N. G. Bailey and G. E. Ulrich 1975 365 p refs
(NASA Order W-13672)
(NASA-CR-146107; PB-244493/3; USGS-GD-74-031) Avail: NTIS HC $10.50 CSCL 03B

An edited record of the conversations between the Apollo 17 astronauts and mission control pertaining to the geology of the landing site is reported. It contains all discussions and observations documenting the lunar landscape, its geologic characteristics, the rocks and soils collected, and the lunar surface photographic record along with supplementary remarks essential to the continuity of events during the mission. This transcript is derived from audio tapes and the NASA technical air-to-ground voice transcription and includes time of transcription and, photographic and sample numbers. The report also includes a glossary, landing site map, and sample table. GRA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-15972 Brigham Young Univ., Provo, Utah.
A SEARCH FOR THE SOURCES OF THE SOLAR WIND IN THE 9.1 cm BRIGHTNESS TEMPERATURE Ph.D. Thesis
Robert Gordon George 1975 152 p
Avail: Univ. Microfilms Order No. 76-697

The sources of solar wind streams have been the object of intensive research for many years, but the various ideas of where and how streams originate on the sun are still incomplete and contradictory. An attempt is presented to find the solar wind sources by mathematically approximating the 9.1 cm brightness temperature which would be expected at the foot of spacecraft-measured solar wind streams and by then comparing it with actual radio brightness temperature measurements. Several significant results were found from an analysis of the correlation results. Most plasma emanating from the sun is found to come from high solar latitudes and to deviate significantly from the normally expected east-west path in the low corona. Magnetic channeling causes correlation studies to fail when the sun's magnetic configuration is unstable. The travel time of the plasma from the sun's 9.1 cm emission level to the earth is often more than a month. Dissert. Abstr.

N76-15973# Smithsonian Institution, Washington, D.C.
PROCEEDINGS OF SYMPOSIUM ON SOLAR RADIATION MEASUREMENTS AND INSTRUMENTATION
1973 478 p refs Symp. held at Rockville, Md., 13-15 Nov. 1973
Avail: NTIS HC $12.50

Papers are presented on the state-of-the-art in solar radiometry. Emphasis is placed on instrumentation, techniques of measurements, and accuracy of the measurements. For individual titles, see N76-15974 through N76-15999.

N76-15974 Smithsonian Institution, Washington, D.C.
ON THE TEMPERATURE DISTRIBUTION WITHIN PYROHELIOMETRIC RECEIVERS
Anders Angstrom *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 11-17 refs (For availability see N76-15973 06-92)

The physical properties of solar measuring devices are examined as a means of increasing accuracy. The temperature radiation distribution of Angstrom pyroheliometers, heated electrically or by solar radiation, is derived. The effect of heat conduction throught the thermojunction is considered along with the relative sensitivity of the instrument. J.M.S.

N76-15975 Smithsonian Institution, Washington, D.C.
BLACK COATINGS FOR THERMAL RADIATION DETECTORS
W. R. Blevin *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 18-31 refs (For availability see N76-15973 06-92)

Methods for measuring the spectral reflectances of black coatings and the thermal resistance between the front and back surfaces of the black coating are reviewed. Other topics discussed include: the thermal capacitance of the black coating and the effect of the black coating on both the amplitude and the phase of the pyroelectric signal in calibrating a pyroelectric detector. J.M.S.

N76-15976 Smithsonian Institution, Washington, D.C.
MEASUREMENTS OF SOLAR ENERGY FOR THE STUDY

OF TIME DEPENDENT METEOROLOGICAL SYSTEMS
S. K. Cox and T. H. VonderHaar *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 32-41 refs (For availability see N76-15973 06-92)

The difficulties of deducing the radiative divergence for relatively large volumes of the atmosphere are discussed. Methods are suggested for circumventing these difficulties in order to provide satisfactory data for the study of time dependent meteorological systems. Author

N76-15977 Smithsonian Institution, Washington, D.C.
PRELIMINARY REPORT ON THE COMPARISON OF TWO ABSOLUTE COMPENSATED RADIOMETERS WITH PACRAD AND THE REPRESENTATIVE INSTRUMENTS OF THE IPS 1956 IN DAVOS (OCTOBER 1973)
D. Crommelynck *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 42 (For availability see N76-15973 06-92)

Absolute compensation radiometers were compared with representative instruments of the IPS 1956 and the absolute radiometer PACRAD. The first radiometer (CROM 2) was equipped with a transversal disk heat fluxmeter as the sensing element, a cylindrical radiative and conductive recuperation element and a flat heating resistor. The second one (CROM 3) was equipped with a transversal ring heat fluxmeter, a conical cavity with a gold spherical mirror as diffused energy recuperation element, and a heating resistor wound on the cone. Preliminary results are discussed. Author

N76-15978 Smithsonian Institution, Washington, D.C.
THE RELATION BETWEEN THE IPS NOW IN USE AND SMITHSONIAN SCALE 1913, ANGSTROM SCALE AND ABSOLUTE SCALE
C. Frohlich *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 61-94 refs (For availability see N76-15973 06-92)

Radiation scales used as references for meteorological radiation measurements are discussed. Specific radiation scales included are: the Angstrom scale, the Smithsonian scale, the Absolute scale, and the International Pyrheliometer Scale. The relations between the radiation scales are stated along with the estimated mean differences between the scales. J.M.S.

N76-15979 Smithsonian Institution, Washington, D.C.
HISTORY OF THE SMITHSONIAN SCALE OF RADIATION
B. Goldberg *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 95-121 refs (For availability see N76-15973 06-92)

Development of the Smithsonian scale based on water flow pyrheliometers is discussed. Structural changes made on the water flow instruments to enhance accuracy are included. The determination of the radiation scale using these instruments is described. J.M.S.

N76-15980 Smithsonian Institution, Washington, D.C.
A NOTE ON OBTAINING SOLAR IRRADIANCE AT THE OCEAN SURFACE WITH SUFFICIENT ACCURACY TO MEET THE REQUIREMENTS OF THE GARP ATLANTIC TROPICAL EXPERIMENT
Kirby J. Hanson *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 122-126 refs (For availability see N76-15973 06-92)

The accuracy of climatological estimates of solar irradiance at the ocean surface is compared to that of direct measurements in terms of the GARP Atlantic Tropical Experiment (GATE) requirements. Results indicate: (1) the differences between climatological estimates exceed the maximum error allowed for the GATE; and (2) data from intercomparisons of field experiments should provide sufficient data to normalize the international pyranometer data set to a single reference standard and meet the required accuracy. J.M.S.

N76-15981 Smithsonian Institution, Washington, D.C.
SOLAR RADIATION MEASUREMENTS CAPABILITY OF THE EARTH RADIATION BUDGET EXPERIMENT OF THE NIMBUS F SATELLITE
J. R. Hickey, D. T. Hilleary, and R. H. Maschhoff *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 127-150 refs (For availability see N76-15973 06-92)

The measurement of direct solar radiation and the solar reflected from the earth by the Earth Radiation Budget Experiment (ERB) aboard the NIMBUS F satellite is described. Aspects of the construction, components, testing, and calibration of ERB instruments are included along with data handling procedures. J.M.S.

N76-15982 Smithsonian Institution, Washington, D.C.
ON THE DESIGN OF ABSOLUTE PYRHELIOMETERS
A. N. Hill *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 151-159 refs (For availability see N76-15973 06-92)

The development of pyrheliometers is discussed in terms of developing self-calibrating instruments. Instruments described include: an actinometer; the Pouillet pyrheliometer; Angstrom's differential pyrheliometers; an electrically self-standardizing antinometer; a mercury pyrheliometer; water flow pyrheliometer; and a feasibility model of an absolute pyrheliometer based on the absolute cavity radiometer. J.M.S.

N76-15983 Smithsonian Institution, Washington, D.C.
TERRESTRIALLY REFLECTED SOLAR RADIATION MEASUREMENTS FROM THE NIMBUS F ERB EXPERIMENT
H. Jacobowitz *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 160-166 (For availability see N76-15973 06-92)

Long term continuous measurement of the earth's radiation budget is discussed in terms of the necessity of the measurements and the degree of accuracy required. The Earth Radiation Budget experiment aboard the NIMBUS F satellite is described. The earth radiation budgets are determined on both synoptic and planetary scales by simultaneously measuring the incoming solar radiation and the outgoing earth reflected shortwave and emitted longwave radiation. Methods of measurements and calculation of heat budgets are described along with calibrating procedures. J.M.S.

N76-15984 Smithsonian Institution, Washington, D.C.
PLANS FOR UPGRADING THE US SOLAR RADIATION PROGRAM
E. A. Jessup *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 167-173 (For availability see N76-15973 06-92)

A brief history of the U.S. Solar Radiation Program is given. The present status of the program is discussed and tentative plans for the future are outlined. J.M.S.

N76-15985 Smithsonian Institution, Washington, D.C.
MAINTENANCE OF THE PYRHELIOMETRIC SCALE AT THE EPPLEY LABORATORY FROM 1930 TO 1972
A. R. Karoli *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 174-189 refs (For availability see N76-15973 06-92)

The history of pyrheliometric reference standards at the Eppley Laboratory is discussed. Calibration of pyranometers, silver disk pyrheliometers, and normal incidence pyrheliometers in terms of the Smithsonian Pyrheliometric Scale of 1913 is described. Through frequent national and international comparisions Angstrom pyrheliometers are used as primary reference standards embodying the International Pyrheliometric Scale of IPS 1956. It is shown that the Eppley Laboratory maintains a reliable reference standard which reproduces the IPS 1956. Author

N76-15986 Smithsonian Institution, Washington, D.C.
FACTORS AFFECTING ACCURACY OF RADIOMETER MEASUREMENTS OF SOLAR IRRADIANCE AND RESULTS OF A MEASUREMENT OF THE SOLAR CONSTANT
J. M. Kendall, Sr. *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 190-202 refs (For availability see N76-15973 06-92)

The effects and magnitudes are discussed of several factors which affect the accuracy of measurements made by radiometers. Emphasis is placed on the PACRAD which is capable of measuring solar irradiance with an absolute accuracy of 0.3%. Factors considered include: discrepancy between the International Pyrheliometer Scale and the absolute scale: circumsolar irradiance; effect of diffraction; radiation loss through the radiometer aperture;

and radiometer temperature. Measurements of the solar constant by PACRAD on Convair 990 flights are discussed. J.M.S.

N76-15987 Smithsonian Institution, Washington, D.C.
REPRODUCTION OF IPS-1956 AT THE UNIVERSITY OF LENINGRAD
K. Ya. Kondratyev and G. A. Nikolsky *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 203-216 refs (For availability see N76-15973 06-92)

The accuracy of the reproduction of the IPS-1956 at the University of Leningrad is discussed. Through the intercomparison of the standard Leningrad University pyrheliometer A-575 with the standard U.S.S.R. and Eppley Laboratory pyrheliometers the accuracy of reference of A-575 to the IPS-1956 was determined to be about 0.2%. The errors due to perfunctory consideration of circumsolar radiation during the pyrheliometric intercomparisons are discussed. The difference between the Smithsonian and Angstrom scale is supposed to reach 6%. Author

N76-15988 Smithsonian Institution, Washington, D.C.
PRINCIPLES OF THE CALIBRATION OF THERMAL RADIOMETERS, ILLUSTRATED BY THE PERFORMANCE OF 12 INSTRUMENTS IN ANTARCTIC FIELD WORK
Michael Kuhn *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 217-268 refs (For availability see N76-15973 06-92)

Calibration of radiometers in a polar environment is discussed. External problems including the methods of exposure of the sensors, their reaction to hoar frost and snow, the choice of recording systems, and electrical grounding are considered along with internal problems such as the instrument response to the prevailing low solar elevations and to low temperatures. Other topics discussed include: principles of the shading method and the observed shading curves of 12 instruments; temperature dependence of the sensitivity of the instrument; and results of shortwave calibrations. J.M.S.

N76-15989 Smithsonian Institution, Washington, D.C.
INTENSITY OF THE CENTER OF THE SOLAR DISK IN THE SPECTRAL REGION 0.33 TO 1.25 MICRON MEASURED FROM HIGH MOUNTAIN STATION
D. Labs and H. Neckel *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 269-307 refs (For availability see N76-15973 06-92)

The method and techniques of absolute radiation measurements are examined. Topics discussed include: calibration procedures; measurement of the intensity of the center of the solar disk vs the mean intensity of the whole disk; high spectral resolution vs a larger bandwidth; and ground-based measurements vs airborne measurements. Measurements of the intensity of the center of the solar disk from a high mountain station are described. J.M.S.

N76-15990 Smithsonian Institution, Washington, D.C.
EFFECT OF TEMPERATURE ON THE LINKE-FEUSSNER PYRHELIOMETER
G. Lamboley *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 308-313 (For availability see N76-15973 06-92)

The method of measurement of the temperature of the Linke-Feussner pyrheliometer is described along with the climatic chamber. Results of the measurements are given and discussed. J.M.S.

N76-15991 Smithsonian Institution, Washington, D.C.
THE CANADIAN ATMOSPHERIC RADIATION PROGRAMME
J. R. Latimer *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 314-325 refs (For availability see N76-15973 06-92)

A summary of the solar and atmospheric radiation measurements made across Canada is given. Topics discussed include: instrumentation and calibration; methods of observation; accuracy of data; and sources of error. A brief history of the development of the Canadian Radiation Network and National Atmospheric Radiation Center is given. J.M.S.

N76-15992 Smithsonian Institution, Washington, D.C.
PROPOSAL FOR A CONSISTENT SYSTEM OF THE BASIC SOLAR RADIATION DATA
H. Neckel and D. Labs *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 326-349 refs (For availability see N76-15973 06-92)

The interrelationships between solar radiation data are considered. Consistent solar radiation tables are constructed. The tables are easily compared and checked with both observations and computations of the central disk continuum as well as with observations of the solar irradiance or its integral value, the solar constant. J.M.S.

N76-15993 Smithsonian Institution, Washington, D.C.
THEORETICAL INVESTIGATIONS OF THE ABSORPTION OF SOLAR RADIATIVE ENERGY IN THE ATMOSPHERE - OCEAN SYSTEM
Ehrhard Raschke *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 350-360 refs (For availability see N76-15973 06-92)

An iterative solution of the radiative transfer equation for plane-parallel layers is used, which allows considerations of the radiation fields in each layer of the model. Anisotropical scattering in the medium and reflections at any boundary as well as absorption varying from layer to layer are easily taken into account. This method of successive orders of scattering is based on an expansion of the phase functions into series of Legendre polynomials to remove the azimuthal dependence in the radiation field. Author

N76-15994 Smithsonian Institution, Washington, D.C.
ESTIMATION OF THE ABSORPTION OF SOLAR RADIATION BY WATER VAPOUR IN THE ATMOSPHERE
G. D. Robinson *In its* Proc. of Symp. on Solar radiation Meas. and Instrumentation 1973 p 361-372 refs (For availability see N76-15973 06-92)

A method of computing water vapor absorption is described. The accuracy of the method is determined. Author

N76-15995 Smithsonian Institution, Washington, D.C.
THE STOCKHOLM REPRESENTATION OF THE IPS 1956
Bertil Rodhe *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 373-393 refs (For availability see N76-15973 06-92)

Calibrating procedures for pyrheliometers are described. Methods discussed include: Angstroms procedure and simultaneous readings. The characteristics of milliammeters and voltmeters are given along with error curves for various instruments. J.M.S.

N76-15996 Smithsonian Institution, Washington, D.C.
SOLAR RADIATION MEASUREMENTS AT WHITE SANDS SATELLITE CALIBRATION SITE
S. Elwynn Taylor *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 394-413 refs (For availability see N76-15973 06-92)

The optical properties of the White Sands ground truth site are examined in terms of providing guidance for the operational instrumentation of the site. Airborne measurements of the site and surface pyranometer measurements provide albedo data for large portions of the site at varying solar angles. The instrumentation utilized is described and the results of the measurements and calculations are tabulated. J.M.S.

N76-15997 Smithsonian Institution, Washington, D.C.
SOLAR ENERGY MONITOR IN SPACE (SEMIS)
Mathew P. Thekaekara *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 414-442 refs (For availability see N76-15973 06-92)
CSCL 03B

Data presented on the solar constant and solar spectrum are evaluated. The absolute accuracy of the data is discussed in terms of the variability of the parameters to be measured. Topics discussed include: distribution of the solar energy as a function of wavelength and variations in solar irradiance. A project developed for more precise and accurate determination of solar irradiance on a continuing basis is described. J.M.S.

N76-15998 Smithsonian Institution, Washington, D.C.
MEASUREMENT OF THE PLANETARY ALBEDO FROM SATELLITES
Thomas H. VonderHaar *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 443-463 refs (For availability see N76-15973 06-92)
CSCL 03B

The need for measurements of the planetary albedo and the required accuracy of these measurements are considered. Results from satellite measurements are given and discussed. Proposed radiation budget and albedo experiments are described. J.M.S.

N76-15999 Smithsonian Institution, Washington, D.C.
ABSOLUTE RADIOMETRY AND THE SOLAR CONSTANT
Richard C. Willson *In its* Proc. of Symp. on Solar Radiation Meas. and Instrumentation 1973 p 464-481 refs (For availability see N76-15973 06-92)

A series of cavity radiometers developed for the accurate measurement of irradiance in absolute units is described in terms of operation and accuracy. Intercomparisons of the International Pyrheliometer Scale, the Angstrom Scale, and the Smithsonian Scale are made. Results of measurements of the solar irradiance by active cavity radiometers in high altitude balloon flights are presented. J.M.S.

N76-16000*# Helio Associates, Inc., Tucson, Ariz.
INTERCOMPARISON OF GROUND-BASED AND SPACE SOLAR FLUX MEASUREMENTS Final Report, 1 Apr. - 31 Oct. 1974
Aden B. Meinel, Dean B. McKenney, and William T. Beauchamp 31 Oct. 1974 114 p refs
(Contract NASw-2568)
(NASA-CR-146087) Avail: NTIS HC $5.50 CSCL 03B

Detailed temporal measurements of the solar flux at one location are performed. These data are then analyzed and compared to the potential of space measurements which allow one to consider the flux falling on areas of the earth. An important result of the research is that the temporal characteristics of the flux in the presence of a real atmosphere would be difficult to obtain from space and that the variations in the flux can be highly significant in regard to most solar conversion schemes. The detailed results of the research are presented. The instruments developed to separate the direct and scattered solar flux, the computer analysis methods developed, and the results of the research, presented as both graphical and tabular data, are discussed. Author

N76-16001# National Oceanic and Atmospheric Administration, Boulder, Colo.
SYNOPTIC OBSERVATIONS OF THE SOLAR
R. A. Howard, M. J. Koomen, D. J. Michels, R. Tousey, C. R. Detwiler, D. E. Roberts, R. T. Seal, J. D. Whitney, R. T. Hansen, S. F. Hansen et al Jul. 1975 207 p refs Prepared in cooperation with Hulburt (E. O.) Center for Space Res. and High Altitude Obs.
(COM-75-50279-48; UAG-48; NOAA-75080601) Avail: NTIS MF $2.25; HC available from Natl. Climatic Center, Federal Building. Attn: Publ., Asheville, N. C. 28801 $25.20/year, $3.00 this issue CSCL 03B

The reports presents a day-to-day summary of coronal data for the first 15 months of OSO-7 operation (11 October 1971 - 15 January 1973). GRA

N76-16002# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 371. PART 1: (PROMPT REPORTS). DATA FOR JUNE - MAY 1975. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975
Hope I. Leighton Jul. 1975 112 p
(COM-75-50193-371-1; SGD-371-Pt-1; NOAA-75081107) Avail: NTIS MF $2.25; HC available from National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications. Subscription $34.00/year includes Part 1 and Part 2; $18.00/year for either part. Annual supplement containing explanation is included. $1.40/copy for either part; $1.30 for extra issue CSCL 03B

The June 1975 data includes alert period, daily solar indices, solar flares, solar radio waves, solar wind measurements, spacecraft observations, solar X-ray radiation, and inferred IP magnetic field polarities. The May 1975 data includes daily solar activity centers, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices, radio propagation indices and related data. GRA

N76-16003# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 371. PART 2: (COMPREHENSIVE REPORTS). DATA FOR JANUARY 1975 - DECEMBER 1974 AND MISCELLANEA. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975
Hope I. Leighton Jul. 1975 28 p refs
(COM-75-50193-371-2; SGD-371-Pt-2; NOAA-75081108) Avail: NTIS MF $2.25; HC available from National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications. Subscription $34.00/year includes Part 1 and Part 2; $18.00/year for either part. Annual supplement containing explanation is included. $1.40/copy for either part, $1.30 for extra issue CSCL 03B

The January 1975 data includes solar flares, solar radio waves, and magnetograms of geomagnetic storms. The December 1974 data includes abbreviated calendar record, and regional flare index. The miscellaneous data includes daily solar activity centers. GRA

N76-16004# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
GALACTIC COSMIC RAY INTENSITY 0.99 TO 5.26 AU FROM THE SUN Progress Report
Michelle F. Thomsen and James A. VanAllen Aug. 1975 58 p refs
(Contract N00014-68-A-0196-0009)
(AD-A014613; U-of-Iowa-75-30) Avail: NTIS CSCL 03/2

The intensity of galactic cosmic radiation in interplanetary space has been observed over the heliocentric radial range 0.99 less than r less than 5.26 a.u. with five Geiger-Mueller tubes on the Jupiter-bound spacecraft Pioneer 10 and over the range 1.00 less than r less than 3.59 a.u. with three similar tubes on Pioneer 11, also bound for Jupiter. The observations span the time period 3 March 1972 to 29 April 1974, near the epoch of minimum solar activity. The contributions of solar energetic particles are eliminated. GRA

N76-16005# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ENTRY OF LOW-ENERGY SOLAR PROTONS INTO THE EARTH'S MAGNETOTAIL Progress Report
Nicolaos A. Saflekos, James A. VanAllen, and Emmanuel T. Sarris Aug. 1975 71 p refs
(Contract N00014-68-A-0196-0009)
(AD-A014612; U-of-Iowa-75-29) Avail: NTIS CSCL 04/1

The access of low-energy solar protons (E sub p = 0.3 MeV) from the interplanetary medium into the earth's magnetotail was studied using observations obtained by Explorers 33, 34, and 35 over a 4.5 year period. Emphasis is on events whose intensity-time profiles exhibit sharply defined discontinuities observed by at least one of the three spacecraft in the interplanetary medium and another within the magnetotail. GRA

N76-15209* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS AND PREDICTION OF DOPPLER NOISE DURING SOLAR CONJUNCTIONS
A. L. Berman and S. T. Rockwell *In its* The Deep Space Network 15 Dec. 1975 p 231-263 refs (For availability see N76-15190 06-12)
CSCL 03B

N76-15210* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CORRELATION OF DOPPLER NOISE DURING SOLAR CONJUNCTIONS WITH FLUCTUATIONS IN SOLAR ACTIVITY
A. L. Berman and S. T. Rockwell *In its* The Deep Space Network 15 Dec. 1975 p 264-272 refs (For availability see N76-15190 06-12)
CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-16006*# California Univ., Los Angeles. Dept. of Physics.
ON THE DETECTION OF MAGNETOSPHERIC RADIO BURSTS FROM URANUS AND NEPTUNE
C. F. Kennel and J. E. Maggs Nov. 1975 20 p refs
(Grant NGL-05-007-190)
(NASA-CR-146068; PPG-245) Avail: NTIS HC $3.50 CSCL 03B

Earth, Jupiter, and Saturn are sources of intense but sporadic bursts of electromagnetic radiation or magnetospheric radio bursts (MRB). The similarity of the differential power flux spectra of the MRB from all three planets is examined. The intensity of the MRB is scaled for the solar wind power input into a planetary magnetosphere. The possibility of detecting MRB from Uranus and Neptune is considered. Author

N76-16007*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES COLLABORATIVE STUDY OF COSMIC RAY NEUTRONS
J. E. Hewitt, L. Hughes, J. B. McCaslin, L. D. Stephens, A. Rindi, A. R. Smith, R. H. Thomas, R. V. Griffith, C. G. Welles, J. W. Baum et al Washington Jan. 1976 40 p refs
(NASA-TM-X-3329; A-6139) Avail: NTIS HC $4.00 CSCL 03B

The results of a collaborative study to define both the neutron flux and the spectrum more precisely and to develop a dosimetry package that can be flown quickly to altitude for solar flare events are described. Instrumentation and analysis techniques were used which were developed to measure accelerator-produced radiation. The instruments were flown in the Ames Research Center high altitude aircraft. Neutron instrumentation consisted of Bonner spheres with both active and passive detector elements, threshold detectors of both prompt-counter and activation-element types, a liquid scintillation spectrometer based on pulse-shape discrimination, and a moderated BF3 counter neutron monitor. In addition, charged particles were measured with a Reuter-Stokes ionization chamber system and dose equivalent with another instrument. Preliminary results from the first series of flights at 12.5 km (41,000 ft) are presented, including estimates of total neutron flux intensity and spectral shape and of the variation of intensity with altitude and geomagnetic latitude. Author

N76-16008*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSSIBLE RADIO EMISSION FROM URANUS AT 0.5 MHz
Larry W. Brown Nov. 1975 13 p refs Submitted for publication
(NASA-TM-X-71033; X-693-75-288) Avail: NTIS HC $3.50 CSCL 03B

Radio emission from the direction of Uranus was detected in data from the radio astronomy experiment on the IMP-6 spacecraft. Previously, emission from the direction of Jupiter and Saturn was observed by the IMP-6 at a number of frequencies near 1 MHz during the period April 1971 to October 1972. These radio bursts were identified in the IMP-6 data through an analysis of the phase of the observed modulated signal detected from the spinning dipole antenna. This technique was applied to the direction of the planet Uranus with possible positive results. Over the approximately 500 days of data, three to six bursts with unique spectral characteristics were found. Identification with Uranus is confused by the likely presence of low level terrestrial and solar emission. The observed events persisted less than three minutes and are strongest in intensity near 0.5 MHz. GRA

N76-16009*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVIDENCE FOR A 17-DAY PERIODICITY FROM Cyg-X-3
S. S. Holt, E. A. Boldt, P. J. Serlemitsos, L. J. Kaluzienski, S. H. Pravdo (Maryland Univ., College Park), A. Peacock (Maryland Univ., College Park), M. Elvis (Leicester Univ.), M. G. Watson (Leicester Univ.), and K. A. Pounds (Leicester Univ.) Sep. 1975 12 p refs Submitted for publication
(NASA-TM-X-71030; X-661-75-260) Avail: NTIS HC $3.50 CSCL 03B

Data taken from the Ariel-5 All Sky Monitor and the Ariel-5 Sky Survey Experiment are analyzed. It is hypothesized that a periodicity of 17d is characteristic of CygX-3. Results of the analysis are given. J.M.S.

N76-16010*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG-TERM X-RAY STUDIES OF Sco X-1
S. S. Holt, E. A. Boldt, P. J. Serlemitsos, and L. J. Kaluzienski (Md. Univ., College Park) Nov. 1975 18 p refs Submitted for publication
(NASA-TM-X-71029; X-661-75-303) Avail: NTIS HC $3.50 CSCL 03B

No modulation of the 3-6 keV X-ray intensity of Sco X-1 at a level of excess of 1% was observed at the optical period of .787313d. Evidence is found for shot-noise character in a large fraction of the X-ray emission. Almost all of the Sco X-1 emission can be synthesized in terms of approximately 200 shots per day, each with a duration of approximately 1/3 day. A pinhole camera was used to obtain data and the data were statistically analyzed. Author

N76-16011# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
POLARIZATION OF COSMIC MASER EMISSION
D. A. Varshalovich and V. V. Burdjuzha 1975 27 p refs
(PR-213) Avail: NTIS HC $4.00

A mechanism for the enhancement of one circular polarized Zeeman component of cosmic OH maser emission sources associated with H2 zones is discussed. This mechanism is observed in the far infrared emission field with the small velocity gradient approximately equaling 0.2 km/sec a.u.. Phenomena affecting the amplification of one mode of Zeeman component are considered. The polarization characteristics of maser spectrum OH are discussed together with structural peculiarities of maser emission, spatial location, and pumping mechanism. ESA

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N76-16012# National Academy of Sciences - National Research Council, Washington, D.C.
OPPORTUNITIES AND CHOICES IN SPACE SCIENCE, 1974
1974 197 p refs
Avail: NTIS HC $7.50; also available Space Science Board, 2101 Constitution Avenue, Washington, D. C. 20418

The strategy and priorities in the NASA space-science program are discussed, and recommendations are made on new starts, medium-term strategy required for planning purposes, and long-term aims. Working papers are presented on space astronomy, space physics, planetary and lunar exploration, space biology and medicine, and future exploration of Mars. M.J.S.

N76-16013# California Univ., Berkeley. Lawrence Berkeley Lab.
LAWRENCE BERKELEY LABORATORY RESEARCH HIGHLIGHTS, FISCAL 75
Dec. 1975 76 p refs
(Contract W-7405-eng-48)
Avail: NTIS HC $5.00

Research data from Fiscal 1975 projects, covering physical

and biological areas are summarized. Data cover solar energy, nuclear fusion, superconducting magnetometers, silicon cells, pulsar measurements, and computer controlled accelerators. Data are also given on the Bevalac biomedical facility, blood-lipid analysis, and bungarotoxin and the brain. E.H.W.